November
1961

COMMERCIAL FERTILIZER

and PLANT FOOD INDUSTRY

a Kraft Bag and The Kraftpacker

automatic open-mouth bag filling machine

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Each does a good job by itself, and you can buy one without the other ...but working together as a team you get a packaging combination that is hard to beat for dependability, efficiency and sound economy.

The **KRAFT BAG** Div.
St. Marys Kraft Corporation, subsidiary of
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Will you extend a hand in welcome to our representative?

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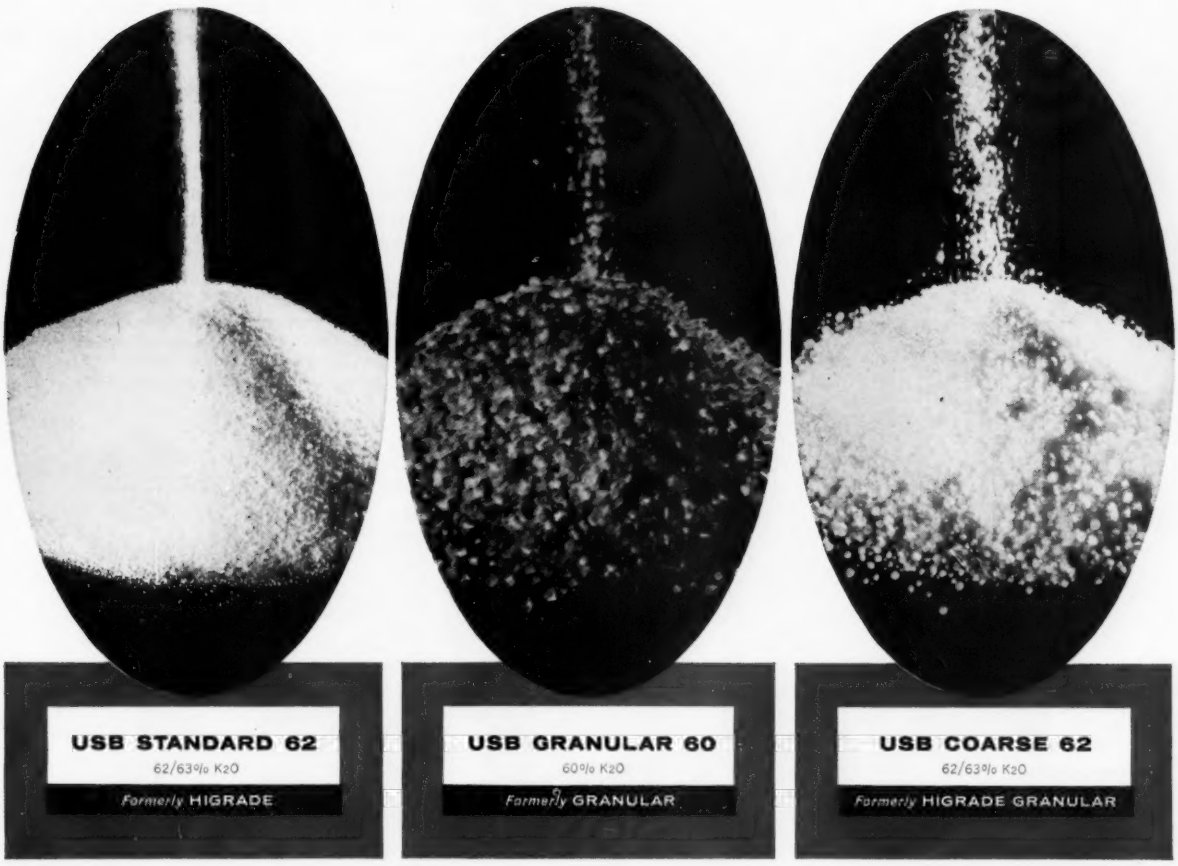
3 types of POTASH specially sized for you...



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Each of our three types of high quality muriate of potash is ideally sized to meet your particular manufacturing requirements. Both of the white grades – STANDARD and COARSE – contain the highest possible K_2O (62/63%) and make feasible the manufacture of the highest analysis mixtures. Our GRANULAR 60 is ideally suited for mixtures requiring muriate of a larger particle size . . . or for direct application. All three products are refined to assure free-flowing and non-caking properties during handling and storage.

For nearly thirty years our products and services have kept pace with your exacting needs. Call, telex or wire one of our nearby offices for prompt delivery.

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COMMERCIAL FERTILIZER

and PLANT FOOD INDUSTRY

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contents

features

meetings

departments

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COMMENTING FREELY

by
Bruce Moran

In all fairness, TVA should be heartily defended by the fertilizer industry against such attacks as the recent fulmination of the US Chamber of Commerce, —which wants the TVA budget cut because "TVA sells fertilizer below market prices".

There is no question that TVA has contributed more to the progress of our industry than almost any research group you could name. True, it has sold fertilizer below market, and even below cost. But this has totalled less than 1% of all fertilizer production— and has gone to energize test areas, and to prove the value of TVA technical developments, which have now been widely adopted by our industry.

We would be first to protest the invasion of our industry by government. We have for years recognized the need for more constructive research in fertilizer. And we join many leaders in the industry in proclaiming in no uncertain terms that this constructive development and test-plot work should be praised and continued, —unless and until private enterprise can match the achievements, carry forward the future projects in the TVA agenda, and make them as freely available to the industry as a whole.

Again...

New Solar nitrogen plant at Joplin, Missouri, dedicated to serving your nitrogen needs still better

The new Solar nitrogen plant at Joplin, Missouri, now extends Sohio service throughout the central part of the United States. The plant, constructed by Solar Nitrogen Chemicals, Inc., enables Sohio (acting as sales agent for Solar) to better serve the nitrogen needs of the fertilizer industry. It substantially increases availability of Solar nitrogen materials during peak seasons.

If you're a regular customer, you know that continuous improvements in service, delivery and product are SOP of the Solar-Sohio team. This leadership has contributed many "firsts" in the fertilizer industry during the past few years. In addition to the new Joplin plant, they have pioneered these improvements in service:

- First to give truck delivery of solutions and anhydrous.
- First to give bulk truck delivery of urea.
- A leader in the use of pressure, aluminum tank cars for nitrogen solutions.
- First to build large bulk storage to meet on-season demand of the industry.
- Further increased on-season availability by increasing capacity of Lima ammonia plant, urea unit and nitric acid unit.

Helping you solve fertilizer formulation problems is another area where the Solar-Sohio team can point to impressive achievements. For example, they...

Photographed July 29
before completion.

something new from the Solar-Sohio team

- Pioneered research in liquid fertilizer solubility.
- Devised practical but accurate shortcuts for methods of liquid formulation . . . i.e., triangulation formulation, formulation pads.
- Led in researching nitrogen solutions solubility and vapor pressure.
- Pioneered special high fixed-to-free nitrogen solutions for dry and liquid manufacturing for complete fertilizers.
- Led in promoting the use of urea-ammonium nitrate solutions to reduce formulation costs of liquid fertilizers.

We believe this record of leadership shows two especially significant facts about our company.

First is a genuine feeling of responsibility to serve your nitrogen needs as completely and as efficiently as we know how. Second is a thorough knowledge of agriculture . . . a real insight into your fertilizer formulation needs.

Right now is a good time to line up your future nitrogen needs. Call or write your "Man from Sohio" for a full line of Solar nitrogen products, including all grades of urea, ammonia and nitrogen solutions. Two plant locations assure dependable supply, quick delivery.

SOHIO

SOLAR NITROGEN CHEMICALS, INC.

Sohio Chemical Company, Agent

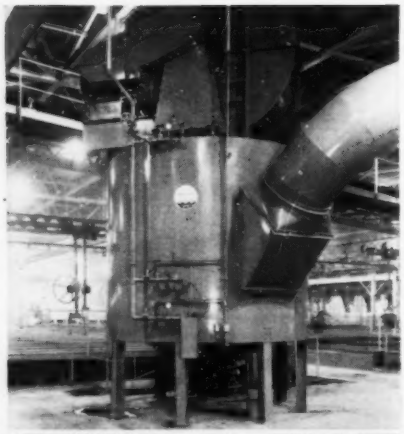
Sales Offices: Lima, Ohio and Kansas City, Mo.

Plants at: Lima, Ohio and Joplin, Mo.

A-12

AIR POLLUTION SOLUTIONS

NATIONAL HYDRO-FILTER®



Top: 30,000 cfm Hydro-Filter similar to this one maintains above 95% efficiency. Handles dust and fume load from plant's dryers, cooler and ammoniator.

Bottom: Water is recirculated through collector from this 2500 gallon tank.

The Case of the Friendly Fertilizer Plant

Problem

With an annual output of 30,000 tons of mixed chemical fertilizer in ten different grades, a large producer was not winning any good-neighbor awards. The phone calls were mounting and the in-plant dust problem was on the increase when management installed a No. 30 Hydro-Filter wet-type dust collector.

Solution

Exhaust gases from the plant's dryer (10,200 cfm at 240°F), cooler (12,500 cfm at 180°F) and ammoniator (6580 cfm at 100°F) were routed through the 30,000 cfm Hydro-Filter. Collected contaminants are drained off to a 2500 gal. sludge tank from which water is recirculated to the collector. Fresh water is added to the collecting system only to compensate for that bled to the ammoniator.

Results

Except for an occasional flushing of the marble bed with a garden hose and routine lubrication of fan and pump, no maintenance of the unit is required. Dust removal efficiency of the Hydro-Filter over the past two years has been maintained at above 95%...on dust loads averaging one grain per cubic foot. The phone calls have stopped. Neighborhood and employee relations are at a *friendly* new high. Equipment investment? . . . Less than $15,000.

Want more details? Write for the complete case history of this installation.

Tired of Dust Collector Maintenance?

HYDRO-FILTER CLEANS ITSELF

Air, water and glass spheres do the work in Hydro-Filter. There are no moving parts in the collection area. No baffles; nothing to load up and no "dead" areas to make cleaning a chore and efficiency a *myth*. It is designed to operate on dusts, mists, fumes, and vapors and can be equipped for recirculation of the liquid scrubbing medium.

Because of its simple, unique design, Hydro-Filter will maintain a constant high level of efficiency over wide variations in volume of air and heavy dust loads. If you're tired of dust collector maintenance . . .

WRITE FOR BULLETIN

Air, Water and Marbles do the job in Hydro-Filter.

Units available from 250 to 40,000 CFM capacity.

Can be equipped with automatic sludge conveyor or furnished with cone bottom.

NATIONAL DUST COLLECTOR CORP.
522 Machinery Hall • Chicago 6, Illinois

HF-161

How Union-Camp's 5-Star Plan saved multiwall user up to $450 per carload of bags

This is a new kind of "Big-Inch" story.

A major mid-west packer* wasn't convinced his multiwall bagging operation was all it might be. Could Union-Camp's 5-Star Multiwall Plan help?

To get the answer, Union-Camp multiwall specialists visited the plant. They found that the automatically filled bags occasionally stuck in the sewing head. Also, that the sewing line tended to "belly" and form an arc pattern. The result was considerable loss in production and frequent breakage. Another problem—the bags didn't warehouse well.

"Sew-Straight" Solution

After completing their analysis, the Union-Camp men suggested installing a "Sew-Straight" attachment right onto the sewing head. The bags could now be closed with an "E" head in a perfectly straight line. And only *1 inch* from the top of the bag. That single inch made all the difference.

Less paper—less breakage

To begin with, shorter bags could be used. The savings in paper alone cut the firm's multiwall costs from between $350 to $450 a carload. Imagine the savings based on several dozen carloads a year!

Before and After. Old, semi-circular closure pattern (left) and the new closure (arrow). Note the straight sewing line, and how close it is to the top of the bag.

The new attachment also speeded production by eliminating sewing head jam-ups. Moreover, since the top closure is now identical to the *factory-sewn* bottom closure, the bags form a perfect pillow shape—no awkward ears. This makes them easier to handle . . . easier to stack. And there's less breakage and fewer rejects.

How much could you save?

Perhaps an idea unearthed through Union-Camp's 5-Star Plan could save you money. The chances are excellent. For every day, multiwall users, large and small, are reducing their multiwall costs by capitalizing on this comprehensive packaging service. Their savings run from a few thousand dollars to over $100,000 a year.

Apart from bag construction, this economy program covers bag design, specifications control, packaging machinery, and a survey of your materials handling operation. And it costs you nothing—regardless of the brand of bags you now use.

FREE 16-PAGE BOOKLET

Write Dept. M-3 today for a free copy of Union-Camp's new 5-Star Plan booklet. It describes many case histories showing how packers like yourself have achieved greater efficiency and economy in their multiwall operation.

UNION-CAMP

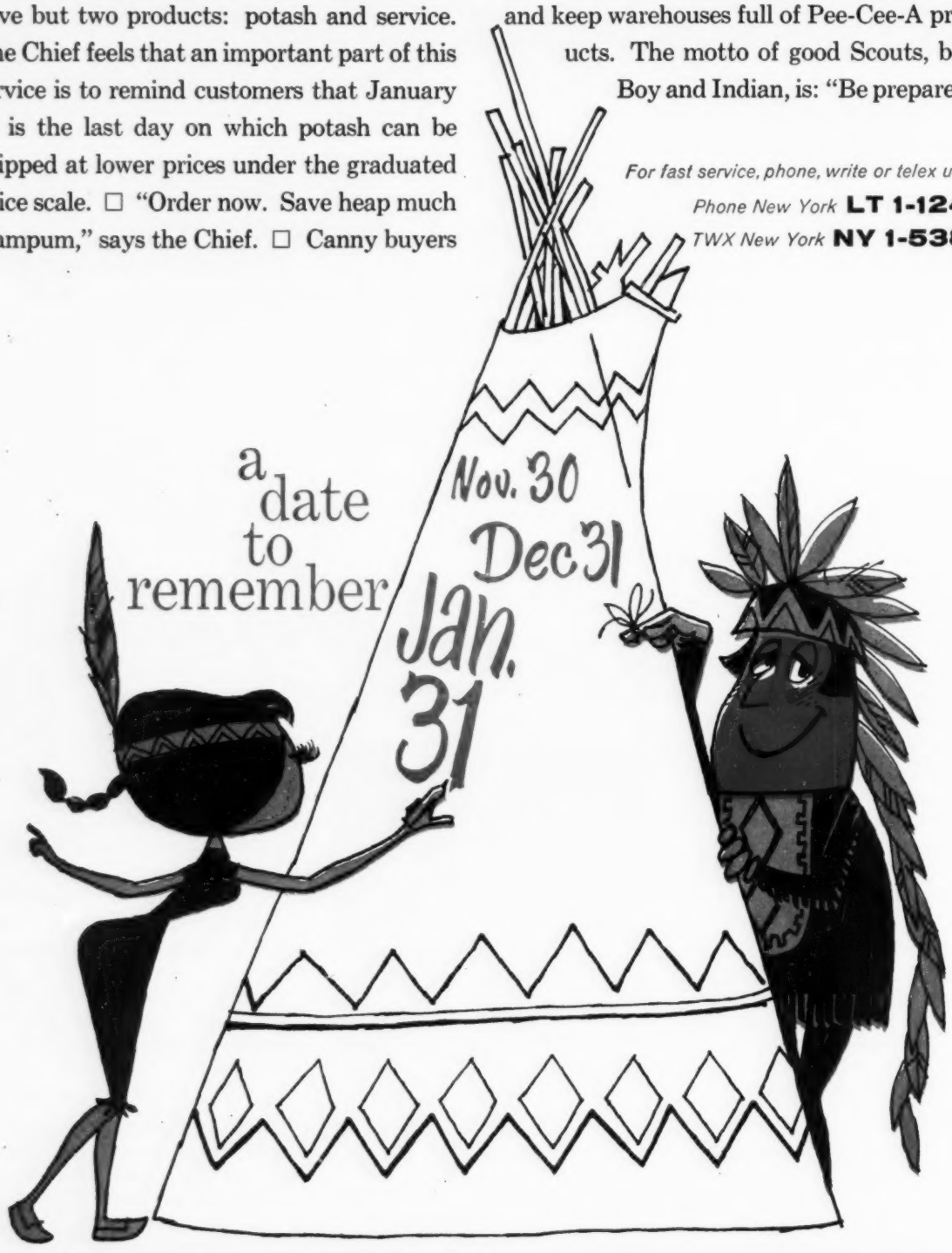
MULTIWALL BAGS

Union Bag-Camp Paper Corporation 233 Broadway N Y 7 N Y

* NAME ON REQUEST

Chief Kay-Two-Oh and the Pee-Cee-A tribe have but two products: potash and service. The Chief feels that an important part of this service is to remind customers that January 31 is the last day on which potash can be shipped at lower prices under the graduated price scale. □ "Order now. Save heap much wampum," says the Chief. □ Canny buyers know that it's good business to plan ahead and keep warehouses full of Pee-Cee-A products. The motto of good Scouts, both Boy and Indian, is: "Be prepared!"

For fast service, phone, write or telex us at:
Phone New York **LT 1-1240**
TWX New York **NY 1-5386**



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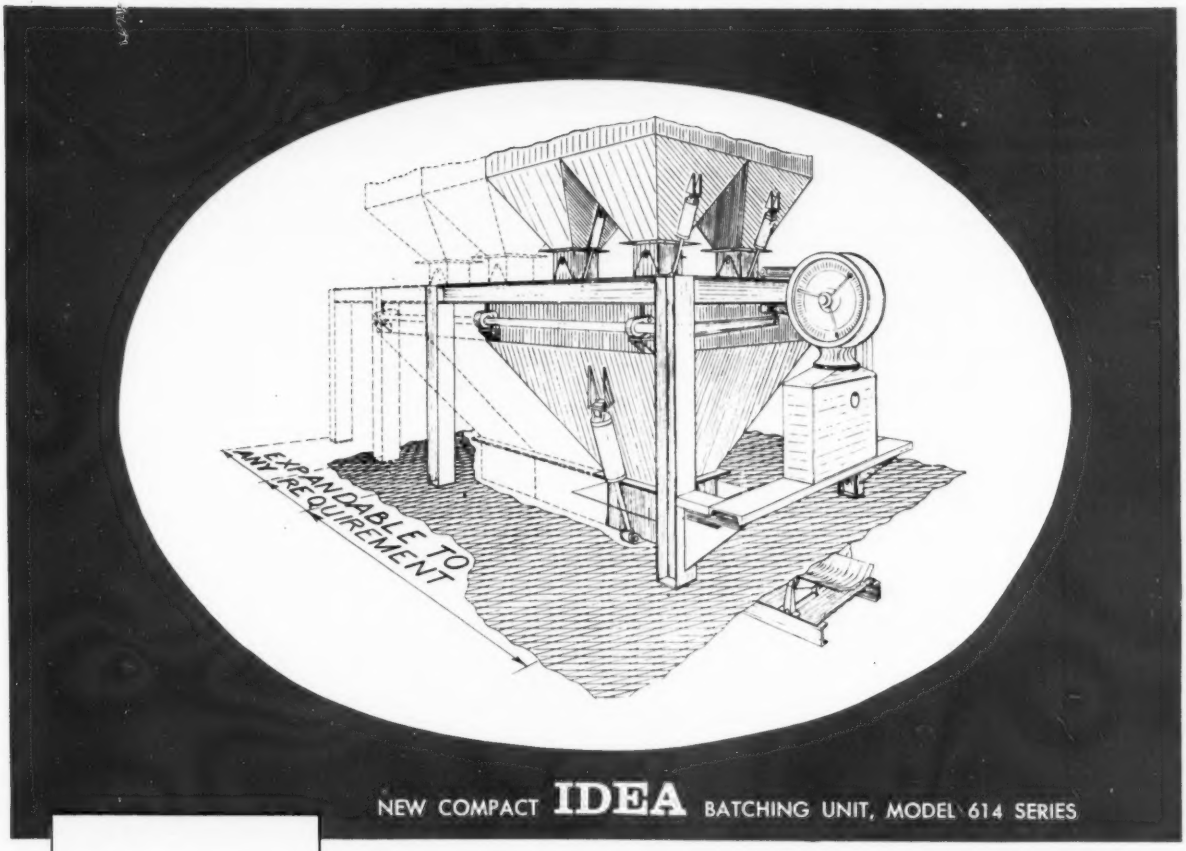
General Sales Office: 630 Fifth Avenue, New York 20
Midwestern Sales Office: First National Bank Building, Peoria, Ill.
Southern Sales Office: 1776 Peachtree Building, N.E., Atlanta, Ga.
Canadian Sales Office: 2 Carlton Street, Toronto 2, Ontario

PCA Standard 60% Muriate of Potash
PCA Coarse 60% Muriate of Potash
PCA Granular 60% Muriate of Potash
Potassium Chloride (99.9% KCL minimum)
Sulphate of Potash

Common-Sense Application of The Extraordinary



NEW COMPACT **IDEA** BATCHING UNIT, MODEL 614 SERIES

INGLETT

specializes in batch weighing, mixing and materials handling systems and new machinery development. Inglett will work with you to determine the system and equipment that will best do the job for you. There is no obligation, NO FEE!

Let's Talk It Over

Economical... This new IDEA Batching Unit is comparable in production to conventional batching systems that are twice the cost! Very compact, takes only a few inches more than an ordinary bagging machine. Versatile, can be set to produce at any rate from lowest tons-per-hour requirement up to 100-tons per hour. Settings for change of analyses can be made in a matter of seconds. Completely automatic, this unit requires no labor whatsoever to operate . . . the perfect batcher for the small-size plant as well as the large.

Get more efficient, more competitive . . . get full details on this economical, versatile IDEA Batching Unit today.

WRITE, CALL OR WIRE

IDEA

- NEW MACHINERY DEVELOPMENT
- BATCH WEIGHING AND MIXING SYSTEMS
- BAGGING & MATERIALS HANDLING SYSTEMS

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AUGUSTA, GEORGIA
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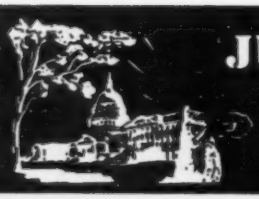


JUST AROUND THE CORNER

By Vernon Mount

WATER PROBLEMS are beginning to get the attention they have deserved so long, and concerning which Commercial Fertilizer Magazine has editorialized for many years back. The water squeeze is beginning to hurt, and is now going to the head of the management priorities list of the Department of the Interior.

USDI POLICY STATEMENT lists these five points:

"1. Wise conservation of the water resources of the arid and semi-arid lands of the United States must now be a paramount objective of resource management.

"2. In many areas of the West existing water supplies are being used to capacity. In some places water is being 'mined' from underground reserves far beyond annual replenishment. In the long run, disregard for the conservation of this vital national resource can only jeopardize existing water uses and limit future growth.

"3. The Department of the Interior recognizes the important impact which its land management programs have on the Nation's water resources. Such recognition in no way infringes on the obligations of the respective States and of citizens themselves to manage and conserve water resources.

"4. In all of its programs the Department of the Interior will adopt policies which encourage the management of water as a renewable natural resource.

"5. Henceforth wherever possible the Department of the Interior will conduct its land management activities on Federal lands in a manner to promote the conservation of water supplies. In its land disposition programs the Department will avoid actions which would endanger the supply of adequate water for existing users or encourage the unwise dissipation of water reserves."

Yours faithfully,

Vernon Mount

call for

CHASE BAGS

when you need packaging

ENGINEERED TO SELL

your product as well as

DELIVER

the goods

!

Your package is the "picture" of your product to your customers and prospects. To make the picture attractive Chase's Art Department is ready to help you design a brand to achieve just the right effect for your purpose. Skilled color printing craftsmen follow through to give you a bag that does a top selling job.

And to make your bag serve—longer and better—we insist on the finest bag materials available, bought in the open market and thus not limited to a single source. Our "kraftsmen" turn these into the toughest bags you ever put feed, seed, fertilizer, chemicals—or anything—into.

If you want bags that are designed to sell as well as made to serve, call your Chase Man. Or write us.

CHASE BAG COMPANY

355 Lexington Avenue · New York 17, N.Y.

** A Chase Bag will make your product a Very Important Package*

MULTIWALLS · TEXTILE · PLASTIC AND LAMINATED BAGS · CONSUMER-SIZE PAPER BAGS AND OTHER PACKAGING MATERIALS

BEMI-STRIP* BAGS WON'T OPEN . . . UNTIL YOU GRAB THE TAB!

Manufacturers are now using millions of these rugged multiwall bags with the patented easy-opening TAB. Their products are shipped, stored, and handled in Bemi-Strip bags with complete confidence that they will not open accidentally.

Your customers, too, will appreciate getting bags that are intact, yet open easily and safely without the aid of cutting tools. Material pours cleaner since there are no thread ends to contend with . . . and in many cases, the bags can be reused because they are undamaged in opening.

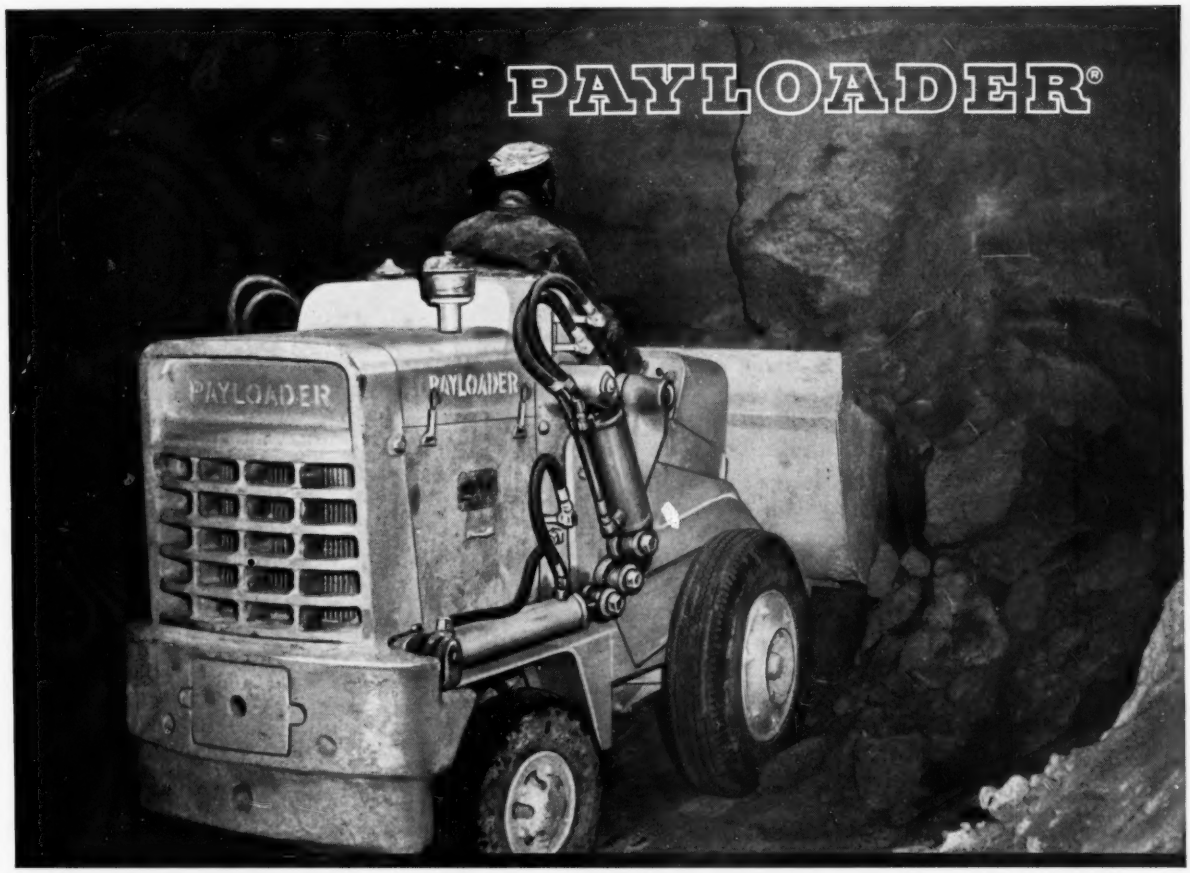
Look for the TAB. It is your assurance that you are getting the original easy-opening bag with guaranteed locking features.

Call your local Bemis packaging specialist. He can demonstrate these Bemi-Strip benefits right in your own plant. Bemis Bro. Bag Co., 408-C Pine Street, St. Louis 2, Missouri.

*Trade-Mark

Bemis

where packaging ideas are born



H-25 produces 20% more in tough digging

"We have been using PAYLOADER *equipment for years with satisfactory performance" . . . says Merchant Fertilizer Co. President M. J. Clement III. "Our H-25 is well into its second season. Lost time has been limited to less than one day. The H-25 is the ideal size . . . it's fast and has much more digging power than manual shift loaders. On dense material, the H-25 gains up to 20% more load-carry production."*

Merchant's Fertilizer Co. of Pensacola, Florida, manufactures commercial fertilizer under the brand name "MERCO" for distribution principally in northwest Florida, Alabama and Mississippi. They use PAYLOADER tractor-shovels almost exclusively for in-plant handling of ingredients. Their present fleet consists of four units of 2000-lb. operating capacity (Models HA and HAH) and a larger Model H-25 that combines a breakout force of 4500-lbs. with 2500-lb. operating capacity.

In operation, the H-25 averages unloading 5 rail cars, on a 75-ft. haul, in 8 hours and delivers material to the bagging operation at a rate of 450 tons in 10 hours. They credit this fine production performance to the H-25's superior basic design and such outstanding mechanical features as power-shift transmission, power-transfer differential and power steering with a short 6-ft. turning radius. In addition, the H-25 has extra protection against dust and dirt "built in" to insure against costly downtime.

Your Hough Distributor wants to show you how an H-25 can "boost production" in your bulk handling requirements. Contact him for a demonstration or return the coupon below.

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY - INTERNATIONAL HARVESTER COMPANY

HOUGH, PAYLOADER, PAYDOZER, PAYMOVER, PAYLOGGER, PAYLOMATIC and PAY are registered trademark names of The Frank G. Hough Co.

THE FRANK G. HOUGH CO.
702 Sunnyside Avenue, Libertyville, Ill.

Send full data on the Model H-25 PAYLOADER

Name _____
Title _____
Company _____
Street _____
City _____ State _____

11-A-4

to the attention of the

FERTILIZER INDUSTRY:

INTERORE and several producers are being sued by an export firm for alleged violations of the Sherman and Clayton Acts. These alleged violations include conspiracy and exclusive dealings in restraint of trade in the export of phosphate rock and phosphatic fertilizers.

These charges are completely unfounded.

Interore wishes to publicly and categorically deny all of the charges.

Interore shall take such steps as are advised by its attorneys to obtain reparations for the wrongs caused by this completely baseless litigation.

INTERORE has been advised by its legal counsel that an individual seller has a legal right to sell to export markets through whomever he wishes.

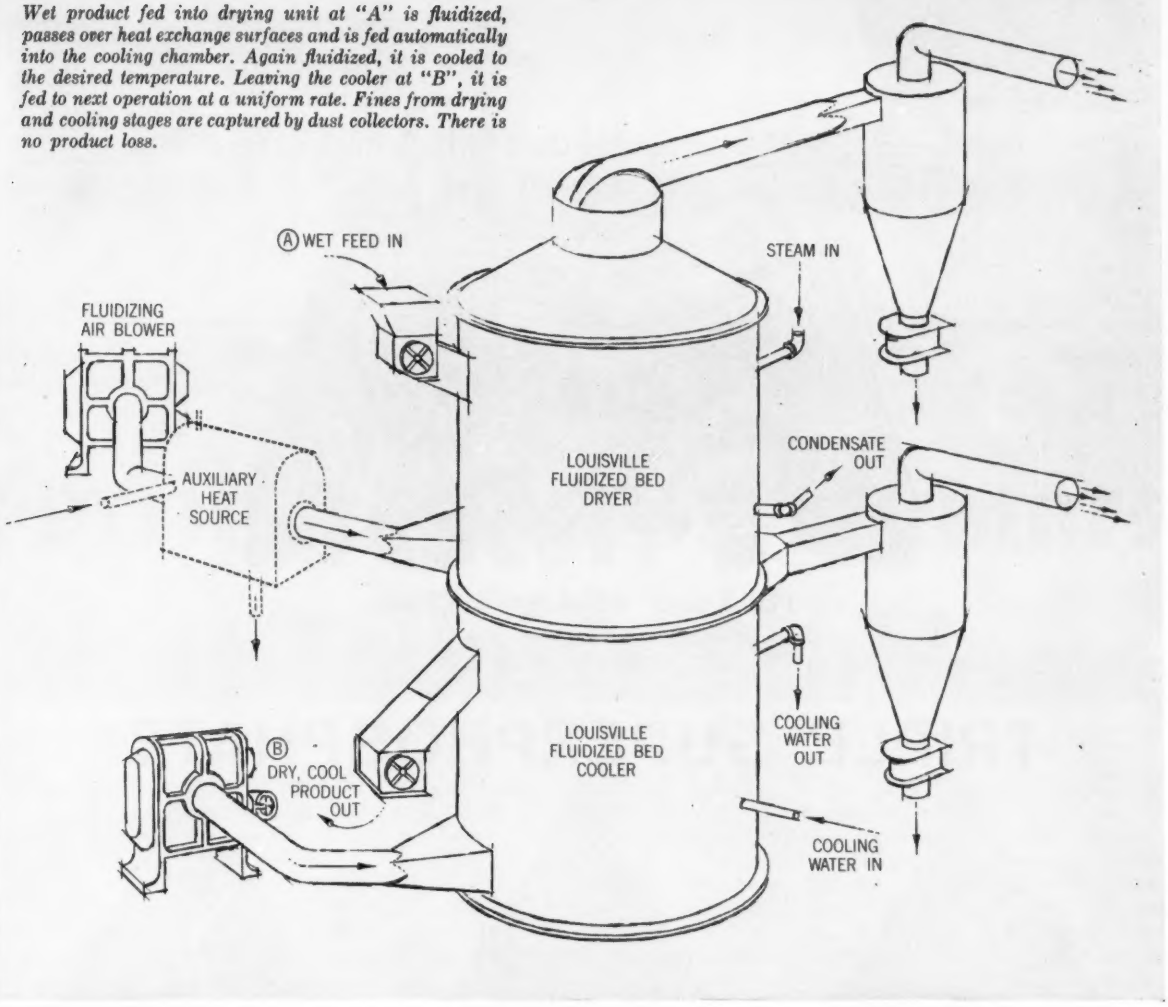
He may sell exclusively through one person or one firm.

He may sell through many firms if he so desires.

There is no legal or moral obligation to do otherwise.

INTERNATIONAL ORE & FERTILIZER CORP.
500 FIFTH AVENUE, NEW YORK 36, N.Y.

Wet product fed into drying unit at "A" is fluidized, passes over heat exchange surfaces and is fed automatically into the cooling chamber. Again fluidized, it is cooled to the desired temperature. Leaving the cooler at "B", it is fed to next operation at a uniform rate. Fines from drying and cooling stages are captured by dust collectors. There is no product loss.



Major Break-Through in Drying and Cooling Techniques for Prilled and Granulated Fertilizers Announced by **GENERAL AMERICAN**

A new system for drying and cooling ammonium nitrate prills, urea prills and granulated mixtures has been perfected by General American through their development of Louisville Fluidized Bed* Equipment. Vertically coupled units functioning as a two or three stage dryer and cooler provide a continuous operation. Dust losses due to attrition are negligible as the material is cushioned by the fluidizing air. High heat transfer permits lower operating temperatures, preventing case hardening and resultant locked-in moisture.

Louisville Fluidized Bed equipment offers these advantages:

1. Accurate, instantaneous temperature control
2. High heat transfer that permits compact design
3. Low maintenance costs (no moving parts)
4. Less cleaning time and labor
5. Less floor space (equipment is vertical)
6. No hot spots (product is fully protected)

Because of their simplicity, Louisville Fluidized Bed dryers and coolers adapt readily to complete automation.

**Patents Pending*

For full details about this revolutionary development in drying techniques, write for bulletin #FBD-61

Process Equipment Division—Louisville Dryers

GENERAL AMERICAN TRANSPORTATION CORPORATION

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PROCESS EQUIPMENT DIVISION GENERAL AMERICAN TRADE MARK

Arcadian® News

Volume 6 | Nitrogen Division, Allied Chemical Corporation | Number 11

Fertilizer Helps Farmers Meet Today's Problems

The fertilizer industry has helped to make farming a dynamic business. Fertilizer has increased the farmer's productive efficiency at a rapid rate. Fewer farms, larger farms and better farming are producing more food and fiber, despite government acreage control programs.

Farmers, like other business men, have found their break-even points rising to levels that make it essential to increase the dollar-producing capacity of their farms. To accomplish this, they are increasing the size of their farms and increasing the yield of every acre that is in production.

The increase in size of farms is shown in the 1959 Census of Agriculture. During the five-year period from 1954 to 1959, the number of farms with sales of more than $10,000.00 in agricultural products increased by 36%. The average acreage per farm increased from 242 acres in 1954 to 302 acres in 1959 or nearly 25%. During the same period, the average value of land and buildings per farm increased by 63%—more than twice as rapidly as the growth in size.

More farmers are now owners of all or part of the land they farm. In 1959, only one farm in five was operated by a tenant.

In addition to increasing their per-farm acreage, farmers are buying more production items to increase their efficiency. For example, from 1954 to 1959, the percent of total farms on which commercial fertilizer was used increased from 60.9% to 78.7%. As a result, the number of acres fertilized *increased* by 9,323,623 in contrast to a decrease of 38,102,782 total farm acres. Total tons of fertilizer used increased from 18,869,117 in 1954 to 19,673,506 in 1959. The average amount of fertilizer per farm increased from 3.9 tons in 1954 to 5.3 tons in 1959.

The 1959 national summary shows data on use of commercial fertilizer by selected individual crops; number of states in which each crop was selected; number of acres on which used; number of tons of dry materials and liquid material used.

The 1961 feed grain program was designed to reduce production by about 18%. Instead, the October estimate is only 11% below last year's record. How did our farmers produce this almost miraculous result? They did it by putting their poorest land in the reserve; by using almost as much fertilizer and chemicals on their best acres as on their total land last year; by increasing the plant population per acre; and by getting good growing weather.

Similarly, the U.S.D.A. estimated on October 9, 1961 that this year's cotton crop would total 14,334,000 bales of

(continued on following page)

Selected Crops	No. of States	No. of Acres Fertilized	Tons Dry Materials	Tons Liquid Materials	Total Tons
Corn	39	50,730,690	6,131,709	653,869	6,785,578
Hay and Cropland pasture	48	13,260,034	2,126,166	54,714	2,180,880
Cotton	12	8,600,447	1,432,958	201,902	1,634,860
Wheat	26	16,991,959	1,292,626	115,385	1,408,011
Non-cropland pasture	48	4,701,760	777,814	17,922	795,736
Tobacco	6	831,964	654,606	2,209	656,815
Irish potatoes	22	883,451	442,418	11,454	453,872
Soybeans	14	2,735,313	275,610	6,093	281,703
Sorghum	4	2,352,711	82,831	70,787	153,618
Sugarbeets	9	650,135	109,761	36,525	146,286
Barley	7	981,551	36,581	16,066	52,647
Oats	5	189,873	16,012	1,335	17,347
All other Crops	48	29,255,920	4,759,003	347,134	5,106,137
		132,133,068	18,137,085	1,536,421	19,673,506

(continued from preceding page)

500 pounds gross weight. This estimate compares with 14,272,000 bales produced last year and 13,553,000 bales for the ten-year (1950-59) average.

Cotton is being grown under planting and marketing controls designed to prevent excess production. As a result, the 1962 cotton planting allotment has been cut by 1.9% despite pleas by growers, the industry and some Southern Congressmen that it be increased because of indicated strong demand, the low level of stocks, and the tense world situation.

Under the control program the national allotment will be broken down among the states, counties and individual farmers largely on the basis of their past plantings. Each farm's marketing quota would be the amount grown on its allotment.

Crops under control programs and grown on excess acres will subject the grower to stiff penalties. Every development in the Federal crop control programs indicates the importance to a grower of having the best possible record of production per acre. All of which makes it more important than ever for growers to have their soil tested and to provide the fertilizer needed for maximum production.

The government's new program of paying farmers to retire a percentage of their acres allocated for planting specified crops has been extended to include additional feed crops and wheat next year. It is estimated that the cost of the enlarged program for 1962 crops may be double the amount paid to corn growers this year.

Under the wheat plan, which has been approved by the growers in a referendum, there would be a mandatory reduction of 10% from individual acreage allotments. Farmers would be paid to reduce their acreage planted to wheat and would receive a support price of $2 per bushel, as compared to $1.79 for the 1961 crop. Also, there are provisions for farmers who cooperate voluntarily to reduce their wheat acreage an additional 30%. It is estimated that the total wheat planting next year may be less than 50 million acres. If weather conditions are good, it is estimated that the 1962 harvest will exceed 1 billion bushels.

During the last 10 years, production per acre of feed crops and wheat has been increasing steadily as a result of the use of improved seeds, more scientific use of fertilizers and better cultivation methods.

The Profitable Use of Phosphoric Acid in Mixed Fertilizer

Under certain conditions phosphoric acid is a valuable source of plant food for the manufacturer of mixed fertilizers. Its high concentration permits formulation of grades that are impossible with other phosphate materials. Its capacity to take up large amounts of ammonia also offers advantages.

In fact, the advantages of phosphoric acid can help manufacturers to produce some formulas more economically, despite its relatively high cost per unit of P_2O_5. One disadvantage of phosphoric acid, as compared to sulphuric acid, is its lower heat of reaction and its higher moisture content. This limits the use of phosphoric acid in semi-granular fertilizers.

Three Different Types

Phosphoric acid is usually known by the process by which it is made—either wet-process acid or furnace acid. This terminology can be misleading because there are two different types of wet-process acid: 1) the ordinary wet-process acid, a dark molasses-type liquid; 2) the refined wet-process acid, a relatively clear liquid with a light green color. The storage and handling characteristics of the latter are very similar to those of furnace acid. With the ordinary wet-process acid, the high impurity content and fluctuating viscosities can create problems.

Furnace acid has the highest purity of the three types, but definite granulating advantages have been noted for wet-process acid. Some operators attribute this to its lower moisture content and its iron and alumina impurities.

Experience has shown that the use of phosphoric acid in conjunction with sulphuric acid in a pre-reactor has improved the performance in both the pre-reactor and the ammoniator. Care should be taken in the selection of the wet-process acid for this use because some acids have been known to cause foaming in the pre-reactor.

Certain grades of wet-process phosphoric acid and sulphuric acid on the market today contain relatively high amounts of organic impurities. When used in fertilizers containing large amounts of ammonium nitrate, the organics can act as a sensitizer, lowering the decomposition temperature of the ammonium nitrate.

Phosphoric acid can be handled with little difficulty if the proper techniques and equipment are utilized. For continuous metering, the float-type flowmeter has given good results with furnace acid and refined wet-process acid. For ordinary wet-process acid, the magnetic flowmeter is a necessity. It is also a good investment for the other types of phosphoric acids. Most of the common batch meters are satisfactory in batch operations but they should be stainless steel for maximum life and performance.

Storage equipment should be constructed of materials specifically recommended for phosphoric acid at the concentrations and temperatures employed. Stainless steel is very satisfactory. It is often used for pipelines and valves. Rubber-lined tank cars are excellent for permanent storage. New developments in fabrication of collapsible rubber tanks offer some interesting possibilities in the transporting, and temporary and permanent storage of phosphoric acid. Certain plastics are also satisfactory for these uses, the largest application being flexible tank liners and pipelines. The pond storage system is also being used for low-cost storage of large quantities of phosphoric acid. This system should not be used and the ponds should not be constructed, however, without first consulting people who are thoroughly experienced in this method. Certain construction techniques are essential for satisfactory performance.

A Word of Warning

Do not use phosphoric acid through sulphuric acid equipment and do not use sulphuric acid through phosphoric acid equipment. This precautionary advice is not due to any danger in mixing the two acids. Materials used in constructing equipment for one of the acids may be completely satisfactory for one of the acids and completely unsatisfactory for the other acid. This fact should be kept in mind when designing connecting systems where there is a possibility of flowback.

Safety equipment and precautions are necessary in handling both phosphoric acid and sulphuric acid.

Arcadian News for Fertilizer Manufacturers from Nitrogen Division, Allied Chemical

AMMONIATING TO GET THE DESIRED RATIOS

You have many different ARCADIAN® Nitrogen Solutions and other materials from which to select those best suited to your formulation needs, whether you produce low-analysis or high-analysis fertilizers in pulverized, granular or semi-granular form.

Making the best selection is not always a simple matter. It can be a perplexing problem to choose the right combination of ingredients to produce the desired weights and plant food ratios and to control moisture and keep costs down.

This is true even in the production of fertilizer from which moisture is not to be removed. It is a more complex problem as analyses are raised and when moisture is to be removed as in granulation, or held to a low level as in semi-granulation.

The table shows how such problems are solved, using three different ARCADIAN Nitrogen Solutions as examples. Many other combinations are obtainable with these and other Solutions.

The table shows how to get a specific ratio of nitrogen to other ingredients within definite weight limits. Three different solutions are shown combined with normal superphosphate, triple superphosphate, sulphuric acid, and phosphoric acid. For efficient use of this table, you can find the pounds of neutralizing ammonia per unit of nitrogen in each solution on the back page of this issue of the ARCADIAN News.

The desired formulation may demand the maximum use of 20% superphosphate for its low-cost P_2O_5 combined with its ability to react with large amounts of ammonia for low-cost nitrogen in the formula. Supplying one unit of P_2O_5 with 20% superphosphate neutralized with six pounds of ammonia from URANA® 6C adds about 122.2 pounds dry weight. The product analyzes 10.6% N and 16.4% P_2O_5 and has a total of 27% plant food.

A great increase in plant food concentration results when one unit of P_2O_5 is supplied by 75% phosphoric acid (54.3% P_2O_5) and this acid is neutralized with 7.2 pounds of ammonia from URANA 6M. Only 58.3 pounds dry weight is involved and the product analyzes 24.6% N and 34.4% P_2O_5.

Flexibility in economy, heats generated, concentration of plant foods and influence on condition are achieved by using triple superphosphate or sulphuric acid for neutralizing ammonia.

Heat of ammoniation varies greatly with different materials. The proper amount of heat aids moisture removal and granulation. To raise one ton of fertilizer 1°F. requires 500 BTU's. Evaporation of one pound of water absorbs about 1,040 BTU's which will cool a ton of fertilizer about 2°F.

HEAT GENERATED BY REACTING AMMONIA

Material	BTU's of Heat per Pound of Ammonia
Superphosphate 20% P_2O_5	1460
Triple Superphosphate	1540
Phosphoric Acid	1900
Sulphuric Acid	2940

Nitrogen Division Technical Service is always ready to help you with ammoniation and formulation problems. Write to Technical Service, Nitrogen Division, Allied Chemical Corporation, 40 Rector Street, New York 6, N. Y.

MATERIALS COMBINED AMMONIATION RATES	BASED ON ONE UNIT	NITRANA® 7				URANA® 6C				URANA® 6M			
		TOTAL LBS. PRODUCT	% N	% P_2O_5	TOTAL %	TOTAL LBS. PRODUCT	% N	% P_2O_5	TOTAL %	TOTAL LBS. PRODUCT	% N	% P_2O_5	TOTAL %
Superphosphate 20%	P_2O_5												
6.0% H_2O													
6.0 lbs. NH_3/Unit P_2O_5													
***WET TOTALS**		**123.7**	**8.65**	**16.2**	**24.9**	**130.0**	**9.92**	**15.4**	**25.3**	**127.3**	**9.4**	**15.7**	**25.1**
DRY TOTALS		116.4	9.2	17.2	26.4	122.2	10.6	16.4	27.0	119.7	10.0	16.7	26.7
Triple Super. 47%	P_2O_5												
3.0% H_2O													
3.0 lbs. NH_3/Unit P_2O_5													
***WET TOTALS**		**54.3**	**9.8**	**36.8**	**46.6**	**57.5**	**11.2**	**34.8**	**46.0**	**56**	**10.7**	**35.7**	**46.4**
DRY TOTALS		52.4	10.1	38.1	48.2	55.3	11.7	36.2	47.9	54	11.1	37.0	48.1
Sulphuric Acid 66° Be	N												
93.19% Acid													
3.1 lbs. Acid/lb. NH_3													
***WET TOTALS**		**79.3**	**25.2**	**0.0**	**25.2**	**75.3**	**26.6**	**0.0**	**26.6**	**76.5**	**26.1**	**0.0**	**26.1**
DRY TOTALS		74.5	26.8	0.0	26.8	70.6	28.3	0.0	28.3	71.7	27.8	0.0	27.8
Phosphoric Acid	P_2O_5												
75% Acid													
54.3% P_2O_5													
7.2 lbs. NH_3/Unit P_2O_5													
***WET TOTALS**		**65.2**	**19.6**	**30.6**	**50.2**	**72.8**	**21.3**	**27.5**	**48.8**	**69.5**	**20.7**	**28.8**	**49.5**
DRY TOTALS		54.5	23.4	36.7	60.1	61.4	25.2	32.6	57.8	58.3	24.6	34.4	59.0

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NITRANA®										
2	41.0	22.2	65.0	—	12.8	27.7	10.8	1.137	10	21
2M	44.0	23.8	69.8	—	6.4	27.8	10.8	1.147	18	15
3	41.0	26.3	55.5	—	18.2	23.6	12.8	1.079	17	–25
3M	44.0	28.0	60.0	—	12.0	23.9	12.7	1.083	25	–36
3MC	47.0	29.7	64.5	—	5.8	24.0	12.6	1.089	34	–30
4	37.0	16.6	66.8	—	16.6	31.5	8.9	1.184	1	56
4M	41.0	19.0	72.5	—	8.5	30.9	9.2	1.194	7	61
6	49.0	34.0	60.0	—	6.0	21.4	13.9	1.050	48	–52
7	45.0	25.3	69.2	—	5.5	26.7	11.2	1.134	22	1
URANA®										
6C	43.0	20.0	68.0	6.0	6.0	27.7	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	26.3	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	22.1	11.0	1.114	22	–15
11	41.0	19.0	58.0	11.0	12.0	24.7	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	19.7	11.7	1.087	25	– 7
13	49.0	33.0	45.1	13.0	8.9	16.1	13.5	1.033	51	–17
DURANA® (contains 8% formaldehyde)										
20	37.0	13.3	53.4	15.9	9.4	25.3	7.2	1.235	0	36
U-A-S®										
A	45.4	36.8	—	32.5	30.7	—	16.2	0.932	57	16
B	45.3	30.6	—	43.1	26.3	—	13.5	0.978	48	46
ANHYDROUS AMMONIA	82.2	99.9	—	—	—	—	24.3	0.618	211	–108

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This is the ninth in a series of articles covering various aspects of the fertilizer dealer-farmer survey made by the authors.

the potential in

GOOD FERTILIZER DEALERS

by GEORGE M. BEAL *and* JOE M. BOHLEN

One of the major concerns of the fertilizer industry today is the marketing structure through which their product is sold. There is a wide variation in the marketing structures being used by various manufacturers to reach their ultimate farmer customers. The future may bring major changes in this marketing structure. However, the local dealer structure, including "farmer dealers", still represents the major route used to sell fertilizer. The complex flow of products has led to margins being taken at several levels. In many cases the basic manufacturer loses his product and brand identity. Often emphasis seems to be placed on number of dealers rather than quality of dealers. Competition for dealers has led to the fear on the part of manufacturers or distributors that they may lose their dealer outlets if they exert pressure on them to increase their education, merchandising and service programs.

In most cases fertilizer is not the major product line of dealers who sell fertilizer. In a study of a random sample of 118 Iowa fertilizer dealers it was found that fertilizer was the major product line of only nine percent of the fertilizer dealers. Even in this case this does not necessarily mean that fertilizer made up over 50 percent of their total volume of business since many of the dealers are carrying more than two product lines.

When asked what role their fertilizer department played in their business the following answers were given by the Iowa sample of dealers.

- 26 percent evaluated their fertilizer department as "a good money-maker in itself"
- 31 percent evaluated their fertilizer department as an *important* customer service
- 26 percent said it was "just another customer service"
- 15 percent stated that it was "not a money maker", but they had to carry fertilizer to compete with other businesses.

Studies done in a southeastern state found that even fewer dealers thought it was "a money-maker in itself", more dealers thought it was an important customer service, and many more dealers said "it was not a money-maker but that they had to carry it to compete with other businesses".

The dealers selling fertilizer in Iowa had this to say about their fertilizer business:

- 31 percent said that the fertilizer business was *poor*
- 23 percent said it was *average*
- 22 percent said the fertilizer business was *excellent*
- 5 percent said the fertilizer business had a *great potential*
- 19 percent gave other answers — some not printable.

The southern states study found even more dealers saying the fertilizer business was "poor".

Only 28 percent of the dealers thought that the margin of profit was adequate. The average mark-up on fertilizer for dealers was 9.3 percent, while the average for all other departments was over 14 percent.

Forty-two percent of the dealers think the farmers see them as "only sellers of needed goods and services", and another ten percent say they are "a friend of the farmer". This leaves slightly under half, 48 percent, who think their role is a consultant on farming and fertilizer matters. Less than half of the dealers thought they should make recommendations to farmers on the analysis, the amount to apply and methods of application. The dealers have a relatively low knowledge about fertilizer and fertilizer use.

The above factors probably all contribute to "price" being one of the main basis for selling fertilizer. Dealers rate "price cutting" as the most frequent competitive practice being currently used that is working to the fertilizer industry's disadvantage in the long run.

One alternative approach is to train dealers to see their fertilizer department as an integral money-making part of their business. If it is possible to upgrade dealers to where they have the basic fertilizer knowledge to program fertilizer use in terms of returns (benefits) to the farmer. These dealers who have higher fertilizer knowledge, see their role as consultants to the farmer on fertilizer matters, are willing to make recommendations and provide a service program to go with their product, are moving larger volumes of fertilizer. They are also maintaining higher mark-ups, indicating that farmers are apparently willing to pay more for this type of a consulting and service program.

However, the basic question facing fertilizer manufacturers and distributors is how to find this type of dealer. One approach to this problem is to determine who the dealers are that are moving large volumes of fertilizer. This does not necessarily mean that only the large volume dealers are performing these consultant service oriented programs. There may be many medium size dealers that are doing an effective job. These medium sized dealers, and in fact many smaller dealers, may have a great potential for fertilizer sales if they are upgraded to better perform this broad consultant, programming and service role.

One finding from the Iowa dealer study was the fact that 26 percent of the dealers were moving approximately 75 percent of the dollar volume of fertilizer. These percentages result when the sample of dealers were divided into those that sold over $50,000 volume and those that sold under $50,000 volume. Though this dividing point is rather arbitrary a comparison of those over $50,000 (designated as high volume dealers)

Data in this report are from an analysis of Iowa State University Experiment Station Project No. 1352 conducted in cooperation with the Agricultural Economics Branch, Division of Agricultural Relations, Tennessee Valley Authority. The project is under the co-leadership of George Beal and Joe Bohlen, professors of rural sociology, Iowa State University. Analysis was carried out by Larry Campbell and Daryl Hobbs, graduate assistants.

and those under $50,000 (designated as lower volume dealers) may provide some important insights into the characteristics of those dealers who are moving the large volumes of fertilizer. This comparison may also give insights into possible alternatives to consider in improving fertilizer sales through the dealer structure.

Economic characteristics	*High volume dealers*	*Lower volume dealers*
Average fertilizer dollar sales	$107,452	$ 14,002
Average gross profit on fertilizer sales	12,947	1,506
Average mark-up on fertilizer	9.9%	8.7%
Average total gross dollar business volume	876,546	302,208

The above data show that the high fertilizer volume dealers, those 26 percent of the dealers who are moving 75 percent of the fertilizer dollar volume, are larger total volume businesses, do almost eight times the dollar volume of fertilizer business, have 8.5 times as much gross profit and maintain a higher mark-up on their fertilizer than do the lower volume dealers.

Eighty-one percent of the high volume dealers were either corporations (36 percent) or cooperatives (45 percent). The lower volume dealers were mainly sole proprietorships (43 percent) and partnerships (26 percent).

Types of Fertilizer Sold

When the forms in which the fertilizer is sold are analyzed the following major differences emerge. While less than ten percent of the high volume dealers were selling dry bagged fertilizer *only*, 38 percent of the lower volume dealers were selling all their fertilizer in this form. Eighty-four percent of the high volume dealers had bulk fertilizer as a part of their operation compared with 46 percent of the lower volume dealers. Twenty-three percent of the high volume dealers had liquid fertilizer as a part of their fertilizer operation compared with ten percent of the lower volume dealers.

Role of Fertilizer Department in the Total Business

The dealers were asked which of four statements best described their perception of the role their fertilizer department played in their total business operation. Table 1 presents the findings from this question.

The same percentages of the high and lower volume dealers saw fertilizer as "a money-maker in itself". However, consistent with the almost three times larger total volume of business almost half of the high volume fertilizer dealers defined their fertilizer department as an important service to bring in business. Twenty-three percent of the lower volume dealers defined their fertilizer department this way. Forty-eight percent of the lower volume dealers saw their fertilizer department as just another customer service or not a money-maker, while 23 percent of the high volume dealers had this perception.

A more specific question was asked to determine the dealers' perceptions of the adequacy of the profit margins in fertilizer. The percentages were almost identical for both the high and the lower volume deal ers, 71 percent thought they were inadequate, and 29 percent thought they were adequate.

Attitudes Toward the Fertilizer Business

To attempt to obtain attitudes toward the fertilizer business the sentence completion technique was used. Each dealer was asked to complete the statement, The fertilizer business is ....". Table 2 presents the findings from this question.

The largest percentage of the lower volume dealers, over twice as many as the high volume dealers, said the fertilizer business was poor". The largest category of high volume dealers, 42 percent, said it was "average". It may be assumed that they believed it was comparable with other lines of business. More of the high volume dealers thought it was "excellent". Nine percent of the lower volume dealers stated the fertilizer business was "a sideline".

Reasons for not Pushing Fertilizer Harder

The sentence completion technique was used to attempt to determine what factors the dealers would give for not pushing fertilizer harder. Each dealer was asked to complete the statement, "I would push fertilizer harder, but ..... The findings are presented in Table 3.

The lower volume dealers were much more concerned with the limiting factors of profit margins, lack of time and lack of facilities. The high volume dealers were much more concerned with credit as a limiting factor. Probably the most significant finding in the table is that, despite the negative wording of the sentence completion statement, 42 percent of the high volume dealers stated they were pushing fertilizer as hard as they could. No lower volume dealers gave this answer.

Knowledge of Fertilizer and Fertilizer Use

In cooperation with agronomists a 10 item fertilizer scale was developed to measure the dealers knowledge of fertilizer and fertilizer use. This scale was regarded as one that included some of the essentials needed by dealers if they were to intel-

TABLE 1. ROLE OF FERTILIZER DEPARTMENT IN THE TOTAL BUSINESS

	High volume dealers	Lower volume dealers
A good money maker in itself	26%	26%
An important service to bring in business	48%	23%
Just another customer service	13%	31%
Not a money-maker, but have to carry fertilizer to compete with other businesses	10%	17%
Don't know	3%	3%

TABLE 2. THE FERTILIZER BUSINESS IS .....

	High volume dealers	Lower volume dealers
Poor	16%	37%
Average	42%	16%
Excellent	26%	21%
Expanding	3%	6%
A sideline	0%	9%
Other (no single category over 3 percent)	13%	12%

TABLE 3. I WOULD PUSH FERTILIZER HARDER BUT .....

	High volume dealers	Lower volume dealers
Profit margin too low	13%	39%
Problems with credit	30%	9%
Lack of time	16%	24%
Lack of facilities	7%	14%
Too much competition	0%	2%
I push it as hard as I can	42%	0%
Other responses (no single category over 2 percent)	19%	12%

TABLE 4. THE DEALER'S ROLE IN MAKING RECOMMENDATIONS

		High volume dealers	Lower volume dealers
1. Should the dealer recommend **how to apply** fertilizer to his customers?			
	Yes	84%	69%
	No	16%	31%
2. Should the dealer recommend the **analysis** to use?			
	Yes	94%	75%
	No	6%	25%
3. Should the dealer recommend the **amount** to apply?			
	Yes	84%	68%
	No	16%	32%

ligently advise their farmer customers on fertilizer and fertilizer use. The total sample of dealers gave correct answers to less than half of the items. However, the high volume dealers did have significantly high knowledge about fertilizer and fertilizer use. The high volume dealers had an average score of 5.4 while the lower volume dealers' scores average 4.3 on the ten item scale.

Two other personnel characteristics of the two dealer categories may be relevant at this point. The high volume dealers had on the average 13 years of formal education while the lower volume dealers had an average of 12.2 years. The high volume dealers were slightly older, 46 years of age, compared with 43 for the lower volume dealers.

Progressiveness of the Dealers

A scale was developed to measure the degree to which the dealers were oriented toward accepting new business, sales and merchandising techniques. Though the average scores for the high volume dealers and the lower volume dealers did not differ greatly, the high volume dealers were significantly more progressive.

The Dealer's Role with his Fertilizer Customers

Two approaches were used to obtain information on the role the dealer thought he performed with his farmer customers. The first approach dealt with the dealers role in making recommendations. The questions and findings are given in Table 4.

Though over two-thirds of the dealers in both the high volume and lower volume categories believed the dealer should play a recommending role, in all cases a greater percentage of the higher volume dealers believed the dealer should play the active recommending role.

Additional data indicate that a greater percentage of the high volume dealers, when compared to lower volume dealers, believed their farmer customers see them as consultants on farming matters in general or specifically on fertilizer matters, rather than just as sellers of needed goods and services.

Merchandising Practices

There is general concensus that the successful dealer is merchandising fertilizer by offering a well rounded education, information programming and service program rather than selling a product on price alone. The following table presents a comparison of the high and lower volume dealers on selected merchandising techniques. It should be cautioned that the data were gathered only on whether or not the techniques were offered or used not on the quality or intensity of use.

With the exception of credit, a greater percentage of the high volume dealers are offering each of the services than are the lower volume dealers. The differences seem especially significant in relation to soil sampling and testing, fertilizer clinics and test plot examinations and direct farmer calls —all basic education and information communication situations. Another significant difference is in the area of bulk application. The slight discrepancy between the percentages regarding bulk application given in this table and those given earlier in the article can be accounted for by the fact that some dealers do not "offer" bulk spreading directly, but set up contract arrangements for the farmer with a third party who does the spreading. Volume and seasonal discounts are also used by significantly more of the high volume dealers.

Certainly not all the questions are consumed in this report. However, the type of analysis used may give important insights into the type of dealers that are presently moving the major volume of fertilizer.

TABLE 5. MERCHANDISING PRACTICES USED BY DEALERS

Merchandising practices	High volume dealers	Lower volume dealers
1. Takes soil samples for farmers	47%	31%
2. Sends in soil samples for farmers	63%	44%
3. Interprets soil test results for farmers	66%	44%
4. Helps farmer plan fertilizer program	81%	73%
5. Calls on farmers to provide information and for direct sale	75%	47%
6. Conducts fall fertilizer test plot examination with specialist present	22%	10%
7. Sponsors fertilizer clinics	28%	12%
8. Provides bulk application	78%	41%
9. Provides anhydrous application	13%	12%
10. Provides small dry fertilizer spreader	44%	35%
11. Offers credit	75%	79%
12. Offers volume discounts	69%	49%
13. Offers seasonal discounts	81%	62%
14. Does newspaper and/or radio advertising	69%	56%
15. Does direct mail and/or provides "hand-outs"	59%	27%
16. Sponsors fair displays or booths	59%	11%

Lime Cost Tax Deduction

An amendment to the Internal Revenue Code of 1954 provides farmers with a clear-cut opportunity to deduct the cost of agricultural limestone and fertilizer and their application when figuring their income tax, the National Limestone Institute says.

It has been a common practice for famers to deduct these costs in the year in which they were incurred. Recently, however, the Internal Revenue Service has questioned this type of deduction on the grounds that it is a capital expense and should be spread over the beneficial life of the limestone or fertilizer. Since this is contrary to the long accepted practice of deducting limestone and fertilizer expenditures in the year they are incurred, Congress added a new section to the Internal Revenue Code which specifically spells out that a farmer may elect to treat as an ordinary business expense, those costs which are incurred in the purchase and application of limestone, fertilizer or other materials used to enrich, neutralize or condition the soil. This new provision is merely a clarification of the existing law and makes no substantial change in the application of the Statute.

While the amendment made by this section applies to taxable years beginning after December 31, 1959, since it is declaratory of existing law, it should be applied to past years as well as by any farmer whose returns are still open for preceding years.

comparison of the COSTS of LIQUID, BULK-BLENDED, and GRANULATED MIXED fertilizers

by

JULIUS SILVERBERG, NORMAN L. SPENCER, AND JOHN R. DOUGLAS, JR.

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ABSTRACT

Comparisons were made of the economics of producing liquid, bulk-blended, and granulated mixed fertilizers. Annual production was assumed to be 5000 tons per year for the liquid and bulk-blending plants and 50,000 tons per year for the granulation plant. Estimates were prepared of total production costs for several ratios of mixed fertilizers at five locations from the Southeast through the Midwest.

Average costs for all ratios and plant locations were \$0.27 to \$0.28 per unit of plant food lower for bulk blends than for the liquid and granulated fertilizers. Although there was little difference in the average costs for the liquid and granulated fertilizers, differences in individual costs varied considerably and favored one or the other depending on ratio and plant location.

EDITOR'S NOTE: *This paper was presented at the 140th meeting of the American Chemical Society, to the fertilizer and Soil Chemistry Section, in September. The authors have modified the content slightly since the presentation, but none of the basic data have been altered.*

Many of our readers —in attempting to evaluate their own competitive cost situation— will find conditions assumed in this paper which do not coincide with their own practices.

Liquid fertilizer mixers, for instance, will note that these formulations use furnace-grade phosphoric acid for all grades, and that supplemental nitrogen is added as ammonium nitrate-urea solution or solid urea; also, that all liquid grades are formulated for no salt-out at 32° F.

Granulators will realize that the marketing pattern assumed by the authors specifies that the entire output will be distributed in bulk form (to offer a closer comparison with bulk blends) with no bagging expense, and that all the production will be sold through company-owned outlets located 100 to 200 miles from the plant.

Through these assumptions, however, the authors have made a sincere effort to offer a valid basis for comparison of costs.

The purpose of this paper is to compare the economics of producing three types of mixed fertilizers: granulated or chemically processed fertilizers, liquid fertilizers, and bulk-blended fertilizers. Each of these types may have one or more outstanding features such as better handling and storage properties, convenience and ease of handling and application, or flexibility of plant food ratios that can be produced. Any of these or other features may be important enough to override economic considerations and should not be ignored in an over-all evaluation of these fertilizers.

Assumptions

Estimates were prepared of production costs for the three types of fertilizer. To provide a reasonable basis of comparison, it was assumed that the plant installations, methods of operation, and annual production would be similar to current practice in the industry.

The simplest marketing situations that are used in the industry were considered applicable. With the relatively small output of many liquid and bulk-blending plants, it is common practice to market the products f.o.b. the processing plants, and this method was assumed for the liquid and bulk-blending plants. With the larger output of the typical plant for production of the granulated, or chemically processed, fertilizer, some method of distributing the product over a wider sales area certainly

would be required. Therefore, it was assumed that products from this plant would be shipped to company-owned distribution stations, which would be located at distances of 100 to 200 miles from the processing plant. The annual sales volume of each distribution station from which products would be sold direct to the consumer would be the same as the annual output of the liquid or bulk-blending plant. All three types of fertilizer would be sold in bulk.

Costs were estimated for six plant food ratios at five locations. The costs were broken down as follows: (1) raw materials, (2) processing of raw materials, (3) sales, and (4) a profit or return on invested capital. For the granulated fertilizer, costs of shipping from the manufacturing plant to the distribution stations and the cost of operating the distribution stations were included.

It was assumed that all plants would purchase all of their input raw materials at the market prices quoted in the spring season of 1961. The delivered costs at the five locations are shown in Table 1; delivered costs are shown because a number of the materials are sold on this basis. It was assumed that the other costs for each process would be the same at each plant location.

Table 1: Delivered Cost* of Raw Materials at Five Locations Used in Study

Material	Delivered cost, $/ton in				
	Minnesota	Iowa	Missouri	Tennessee	Georgia
Anhydrous ammonia, 82.3% N	92.00	98.50	94.50	98.50	99.70
Nitrogen solutions					
Ammoniating					
44.8% N	59.14	64.24	61.54	62.34	62.84
41.0% N	54.12	59.22	56.52	57.32	57.82
Nonammoniating, 32% N	52.48	57.58	54.88	55.68	56.18
Ammonium nitrate, 33.5% N	67.50	66.50	65.29	66.50	67.70
Ammonium sulfate, 20% N	38.50	35.20	34.16	35.20	38.20
Urea, 45% N	90.00	90.00	90.00	90.00	90.00
Diammonium phosphate (18-46-0)	94.60	91.50	89.40	87.20	83.20
Ordinary superphosphate, 20% P_2O_5	23.00	23.00	21.00	20.00	17.00
Concentrated superphosphate					
Nongranular, 46% P_2O_5	63.10	60.00	57.90	55.70	51.70
Granular, 46% P_2O_5	65.10	62.00	59.90	57.70	53.70
Phosphoric acid (furnace), 54% P_2O_5	90.02	88.09	82.00	82.00	87.70
Potassium chloride					
Standard, 60% K_2O	35.87	35.97	35.87	38.15	38.69
Standard, 62% K_2O	36.61	36.71	36.61	38.89	39.43
Granular, 60% K_2O	37.62	37.31	37.21	39.49	40.03
Sulfuric acid, 93% H_2SO_4	23.50	22.00	20.00	17.00	17.00

* Based on published price lists and rail freight rates, spring, 1961.

Descriptions of Plants, Operations, and Formulations

The granulated fertilizer would be produced in a TVA-type continuous ammoniation-granulation plant equipped for drying, cooling, and sizing of the product. The plant would have a capacity of 20 to 25 tons per hour and an annual output of 50,000 tons. The cost of the plant was taken as $600,000. Conventional raw materials were used in formulating the granulated fertilizers and include ammonia and ammoniating solutions, superphosphate, and sulfuric acid. Diammonium phosphate (18-46-0) was used in two formulations. The grades were the popular ones normally produced in the industry, although somewhat higher grades can be made.

The liquid fertilizers would be produced in a batch-type plant having a 1000-gallon (5-ton) reactor. The plant would have an annual output of 5000 tons and would cost $50,000. The grades of liquid fertilizer would be the highest that would not salt out during storage at about 32° F. Electric-furnace phosphoric acid was used as the source of P_2O_5. Supplemental nitrogen was supplied as urea —ammonium nitrate solution

Table 2: Formulations for Fertilizer Grades Used in the Study

		Pounds per ton					
	Ratio	1:1:1	1:2:1	1:3:1	2:1:1	1:2:2	1:3:3
Granulated	Grade	**12-12-12**	**10-20-10**	**8-24-8**	**20-10-10**	**10-20-20**	**6-18-18**
Anhydrous ammonia (82.3% N)		---	---	---	---	---	148
Ammonium nitrate (33.5% N)		---	---	---	704	---	---
Ammonium sulfate (20% N)		195	---	---	---	---	---
Nitrogen solutions		494 (41% N)	452 (44.8% N)	396 (41% N)	250 (44.8% N)	375 (44.8% N)	---
Diammonium phosphate (18-46-0)		---	---	---	335	240	---
Ordinary superphosphate (20% P_2O_5)		558	559	686	242	--4	495
Triple superphosphate (46% P_2O_5)		285	645	756	---	678	576
Potassium chloride (60% K_2O)		400	333	267	333	667	600
Sulfuric Acid (93% H_2SO_4)		171	75	---	150	106	214
Liquid	Grade	**9-9-9**	**8-16-8**	**6-18-6**	**14-7-7**	**5-10-10**	**3-9-9**
Anhydrous ammonia (82.3% N)		73	129	146	57	81	73
Urea—ammonium nitrate solutions (32% N)		188	167	---	211	104	---
Urea (45% N)		133	---	---	368	---	---
Phosphoric acid (54% P_2O_5)		333	593	667	259	370	333
Potassium chloride (62% K_2O)		290	258	194	226	323	290
Bulk Blended*	Grade	**19.3-19.3-19.3**	**15.4-30.8-15.4**	**12.2-36.6-12.2**	**27.0-13.5-13.5**	**12.3-24.5-24.5**	**8.7-26.0-26.0**
Urea (45% N)		520.93	148.70	---	964.17	118.34	---
Diammonium phosphate (18-46-0)		837.21	1,338.29	1,356.93	586.32	1,065.09	964.36
Triple superphosphate (46% P_2O_5)		---	---	235.99	---	---	167.71
Potassium chloride (60% K_2O)		641.86	513.01	407.08	449.51	816.57	867.92

* All granular materials.

or solid urea if required to make grade. It is recognized that the recently developed urea —ammonium nitrate solutions that contain some ammonia are lower priced and might be used to some advantage.

For production of bulk blends, a 1-ton-capacity rotary mixer was assumed; the granular raw materials would be proportioned to the mixer with weigh hoppers. The annual output would be 5000 tons and the plant would cost $40,000. The grades were those that could be produced most economically with available raw materials and were calculated to the nearest tenth of a unit of plant food. The raw materials included solid urea, 18-46-0 diammonium phosphate, concentrated superphosphate, and potassium chloride. Urea was used rather than ammonium nitrate because the delivered costs per unit of nitrogen were about the same and the use of urea made possible a higher grade product.

The grades and formulations used in this study are shown in Table 2.

Costs Exclusive of Raw Materials

The estimated production costs per ton of product, exclusive of raw materials, are given in Table 3. This cost for the granulated fertilizer was about twice as high as for the other types: $20.46 as compared with $10.10 for liquids and $8.95 for bulk blends. Much of the difference, about $7.00, was due to the cost of shipping to and operating the distribution stations for the granulated product. The individual costs for plant operations generally were higher for the granulation plant because of the costs attendant to the higher investment and labor requirements for this more complicated operation. The costs of plant operation were $6.55 for the granulated product as compared with $4.60 for the liquids and $3.95 for bulk blends.

A 20% return on investment was assumed for this study. The investment was taken to include both fixed and working capital. In each case, average working capital was estimated at 25% of plant cost. Fixed and working capital for the three plants are tabulated below. Return on investments were $3.75 per ton for the granulated products, $2.50 for liquids, and $2.00 for bulk blends.

	Capital cost, $		
	Fixed	Working	Total
Granulated	800,000*	200,000	1,000,000
Liquid	50,000	12,500	62,500
Bulk blend	40,000	10,000	50,000

* Includes processing plant cost of $600,000 plus cost of 10 bulk distribution stations at a total cost of $200,000.

The sales expense was assumed to be $3 per ton for each type of fertilizer.

The production costs per unit of plant food, exclusive of raw materials (hereafter called "fixed cost"), are given in the first column of Table 4. For the granulated fertilizer, these costs ranged from $0.41 to $0.57; the lowest cost for the most concentrated grade —the 10-20-20 containing 50 units of plant food— and the highest cost for the 12-12-12 grade, which contained only 36 units of plant food.

For the liquids, the fixed cost per unit of plant food ranged from $0.31 for the most concentrated grade — the 8-16-8 containing 32 units— to $0.48 per unit for the least concentrated grade —the 3-9-9, which contained only 21 units of plant food.

The bulk-blended products were somewhat more concentrated than either of the other two and contained 52 to 63 units of plant food. Fixed costs for the blends ranged from $0.14 to $0.17; they were about $0.20 per unit lower than for the liquids and about $0.30 lower than for the granulated fertilizer.

Formulation Costs

The cost of raw materials per unit of plant food for the formulation at each plant location is shown in Table 4. The cost was lowest for the granulated fertilizer, and there was little difference between the liquids and bulk blends except for the 1:3 $N:P_2O_5$ ratios because of the larger proportion of P_2O_5 as acid used in the liquids. The average total cost of the raw materials used for granulation and bulk blending decreased as the assumed plant location was moved from north to south, principally because of the lower cost of solid phosphatic materials. For the liquids, there was not much difference except at the Missouri location where both the phosphoric acid and anhydrous ammonia were lower in delivered price due to the close proximity of plants that produce these materials.

Comparison of Total Costs

The total costs of production are shown in Table 4 and are plotted in Figure 1. Costs also are shown in Table 4 for each ratio and plant location and are averaged to show the effect of each. The average costs for all ratios and plant locations were $1.37 per unit for the bulk blends, $1.64 for liquids, and $1.65 for the granulated fertilizer. The cost advantage of the blends was due chiefly to the low unit fixed cost (cost exclusive of raw materials), which averaged $0.15 as compared with $0.38 to $0.50 for the other types of fertilizers.

Although there was little difference in the over-all average costs for the liquid and granulated fertilizers, differences in individual costs varied considerably and favored one or the other depending on ratio and plant location. Examples are the 1:3:3 and the 2:1:1 ratios. For the 1:3:3 ratio, the granulated fertilizer was somewhat cheaper than the liquid. The chief reason for the difference was the low analysis of the liq-

Table 3: Estimated Production Cost Excluding Raw Materials*

Item	$/ton of product		
	Granulated	Liquid	Bulk blend
PLANT OPERATION			
Direct operating labor, estimated	1.49	0.70	0.70
Direct supervision and clerical, estimated	0.47	0.35	0.35
Maintenance, 4% of plant investment	0.48	0.40	0.32
Operating supplies, 50% of maintenance	0.24	0.20	0.16
Power, at $0.015/kw.-hr.	0.23	0.05	0.05
Fuel, natural gas at $0.40/MCF	0.08	---	---
Water, at $0.20/M gal.	0.03	0.02	---
Property taxes and insurance, 2% of plant cost	0.24	0.20	0.16
Analyses, estimated	0.15	0.10	0.05
Depreciation: granulation, 15 yr.; others, 10 yr.	0.80	1.00	0.80
Interest, 6% on fixed and working capital	0.90	0.75	0.60
Overheads, 50% of all labor, maintenance, and supplies	1.44	0.83	0.76
Subtotal	**6.55**	**4.60**	**3.95**
Return on investment (20%)	3.75	2.50	2.00
Sales	3.00	3.00	3.00
Freight to distribution plants	5.00	---	---
Operation of distribution plant	2.16	---	---
TOTAL	**20.46**	**10.10**	**8.95**

* Called "fixed cost".

uid. Only a 3-9-9 grade could be made without the material salting out during storage at 32° F., and with only 21 units of plant food, a high unit fixed cost resulted. The cost difference between the two fertilizers ranged from $0.09 to $0.18 per unit; the largest difference was at the southeast location where the costs of raw materials were more favorable for the granulated fertilizer. For the 2:1:1 ratio, the liquid fertilizer was cheaper by $0.06 to $0.14 per unit. Although costs of raw materials for the liquids were slightly higher, the fixed cost was significantly lower ($0.15/unit).

In considering the average costs for all ratios, plant location had little effect on differences in costs between the three types of products except in Georgia. At the other four locations, bulk blends had an advantage of $0.23 to $0.27 per unit of plant food over liquids and liquids had a $0.02 to $0.04 advantage over the granulated product. At the Georgia location, the granulated product had an advantage of $0.07 over the liquids but still was $0.29 more expensive than the bulk blend.

On the basis of the average total cost for all locations for each ratio, the bulk blends had an advantage of $0.20 to $0.29 per unit over the next lowest cost type of fertilizer. The greatest differences between the costs of the liquid and granulated fertilizers were about $0.11 per unit in favor of the liquids for the 2:1:1 and $0.10 in favor of the granulated fertilizers for the 1:3:3 ratio; in the other ratios the cost differences were $0.05 per unit or less.

Discussion

The study was based on specific assumptions for sizes and types of plants, types of raw materials, and concentrations of products, and it should be recognized that changes in these assumptions could affect the results considerably. For example, the production of granulated fertilizers based on nitric phosphates or ammonium phosphates in large-scale operations, which include facilities for production of some of the raw materials, should show a cost advantage over the plant operation used in this study. Estimates made several years ago by Stanfield **(3)** showed that savings of as much as $0.40 per unit of plant food might be obtained by production of nitric phosphates at the rate of 200,000 tons per year as compared with the production of 50,000 tons per year of conventional granulated fertilizers.

There also are several possibilities

Table 4: Total Estimated Production Costs for Granulated, Liquid and Bulk-Blended Fertilizers at Five Locations

		Cost, $/Unit Plant Food										
			St. Paul, Minn.		Des Moines, Iowa		St. Louis Mo.		Columbia, Tenn.		Moultrie, Ga.	Average total cost at all
	Grade	Fixed costs* at all locations	Raw material	Total	Raw material	Total	Raw material	Total	Raw material	Total	Raw material	Total	locations for each ratio
1:1:1													
Granulated	12-12-12	0.57	1.16	1.73	1.17	1.74	1.12	1.69	1.11	1.68	1.09	1.66	1.70
Liquid	9-9-9	0.37	1.28	1.65	1.30	1.67	1.24	1.61	1.26	1.63	1.30	1.67	1.65
Bulk blend	19.3-19.3-19.3	0.15	1.29	1.45	1.27	1.42	1.26	1.41	1.25	1.40	1.22	1.38	1.41
1:2:1													
Granulated	10-20-10	0.51	1.18	1.69	1.18	1.69	1.13	1.64	1.12	1.63	1.07	1.58	1.65
Liquid	8-16-8	0.31	1.30	1.61	1.31	1.62	1.24	1.55	1.26	1.57	1.32	1.63	1.60
Bulk blend	15.4-30.8-15.4	0.14	1.29	1.43	1.26	1.40	1.24	1.38	1.22	1.36	1.17	1.32	1.38
1:3:1													
Granulated	8-24-8	0.51	1.18	1.69	1.17	1.68	1.13	1.64	1.11	1.62	1.05	1.56	1.64
Liquid	6-18-6	0.33	1.34	1.67	1.34	1.67	1.26	1.59	1.28	1.61	1.35	1.68	1.64
Bulk blend	12.2-36.6-12.2	0.15	1.29	1.44	1.25	1.40	1.23	1.37	1.20	1.35	1.15	1.30	1.37
1:2:2													
Granulated	10-20-20	0.41	1.14	1.55	1.13	1.54	1.10	1.51	1.09	1.50	1.06	1.47	1.51
Liquid	5-10-10	0.40	1.16	1.56	1.17	1.57	1.11	1.51	1.13	1.53	1.18	1.58	1.55
Bulk blend	12.3-24.5-24.5	0.15	1.15	1.29	1.13	1.27	1.11	1.25	1.11	1.25	1.07	1.21	1.25
2:1:1													
Granulated	20-10-10	0.51	1.44	1.95	1.43	1.94	1.39	1.90	1.40	1.91	1.38	1.89	1.92
Liquid	14-7-7	0.36	1.45	1.81	1.46	1.82	1.42	1.78	1.44	1.80	1.47	1.83	1.81
Bulk blend	27.0-13.5-13.5	0.17	1.47	1.63	1.46	1.62	1.45	1.61	1.44	1.60	1.42	1.58	1.61
1:3:3													
Granulated	6-18-18	0.49	1.05	1.54	1.03	1.52	0.99	1.48	0.99	1.48	0.95	1.44	1.49
Liquid	3-9-9	0.48	1.13	1.61	1.12	1.60	1.07	1.55	1.09	1.57	1.14	1.62	1.59
Bulk blend	8.7-26.0-26.0	0.15	1.09	1.24	1.07	1.21	1.05	1.19	1.04	1.19	1.01	1.15	1.20
Average total cost of all ratios at each location													
Granulated					1.69		1.69		1.64		1.64		1.60
Liquid					1.65		1.66		1.60		1.62		1.67
Bulk blend					1.41		1.39		1.37		1.36		1.32

Over-all Mean for All Ratios and Locations, $/Unit Plant Food

	Fixed cost*	Raw materials	Total
Granulated	0.50	1.15	1.65
Liquid	0.38	1.26	1.64
Bulk blend	0.15	1.22	1.37

* Exclusive of raw materials.

for decreasing the costs of liquid fertilizers. In this study, it was assumed that they would be made with furnace phosphoric acid, which commonly is used in industry, since the use of wet-process acid introduces problems in handling, storing, and distribution because of the impurities that precipitate during ammoniation. However, wet-process acid generally is priced lower than furnace acid ($1.39 vs. $1.52/unit P_2O_5, f.o.b.), and its use should increase with advances in technology for producing liquid and suspension-type (2) fertilizers. The use of wet-process instead of furnace acid in this study would result in a saving of $0.03 to $0.10 per unit of plant food: the lower figure for the 14-7-7 grade, in which the proportion of P_2O_5 is smallest, and the higher figure for the 6-18-6 grade, in which the proportion of P_2O_5 is largest. Also, where higher salting-out temperatures can be tolerated, the production of higher grades of liquids would decrease the fixed cost as well as subsequent handling costs.

Interest in salt-suspension fertilizers (1) is increasing because of the dual advantage of using wet-process acid and producing high concentrations of plant food. Under the conditions of this study, the cost of producing a 12-12-12 salt-suspension fertilizer from wet-process acid would be about $0.13 per unit less than that of producing a 9-9-9 liquid from furnace acid.

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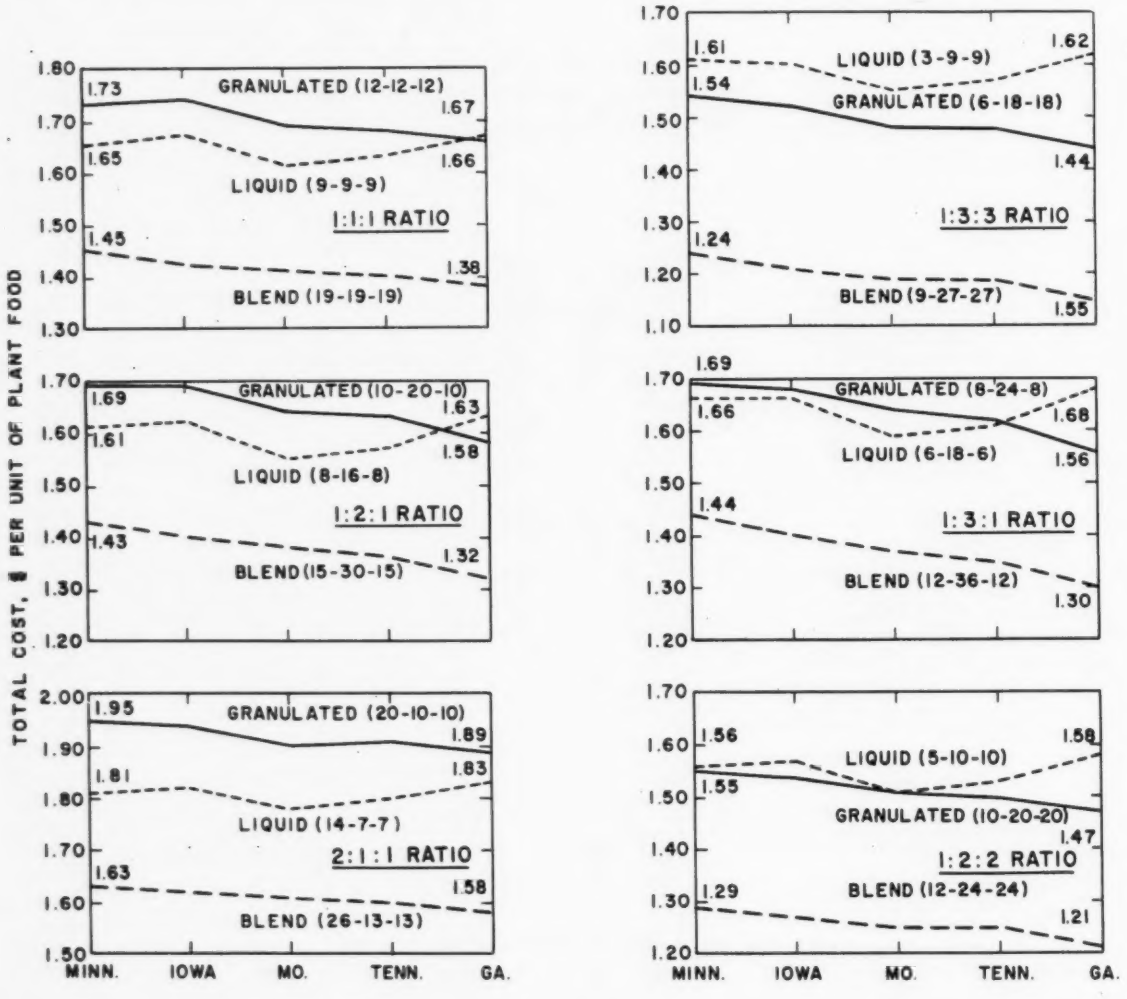

FIGURE 1. COMPARISON OF TOTAL PRODUCTION COSTS FOR GRANULATED, LIQUID, AND BULK-BLENDED FERTILIZERS.

The International Scene

PHILIPPINES

Nitrate of potash imports led N list for 1960

According to the Philippine Bureau of Census and Statistics, manufactured fertilizer imports for the year 1960 were valued at 14,937,730 pesos, made up of nitrogenous fertilizer 3,512,596 pesos, potassic fertilizer 1,610,939, and fertilizer, n.e.s. 4,751,839.

Of the nitrogenous fertilizers, nitrate of potash led the list, reaching a record 3,568,575 kilos valued at 312,195 pesos, followed by nitrate of soda at 25,942 pesos.

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FOREWORD

By Sir Clavering Fison, D. I., Chairman of Fisons Ltd.

The British Sulphur Corporation, through its Journals "Nitrogen" and "Sulphur," is already well known in the chemical industries of the world and requires no introduction. In recent years, however, the Corporation has extended its operations to cover phosphates and the first result is the publication of this survey.

Since the XIVth International Congress in Madrid in 1926 there has been no comprehensive survey of phosphate deposits and in the intervening years much progress has been made in all aspects of phosphate rock production.

In industry today, it is of the utmost importance that those who direct shall have at their disposal concise and accurate information on the availability of their raw materials. I believe that this survey, which has taken over four years to compile and in many cases has included visits to the deposits under review, will provide an essential source of information to those whose day to day business is connected with this important raw material.

I am equally confident that it will become a standard work of reference in the Technical Libraries, Colleges and the Universities throughout the world.

MICRONUTRIENT USES in fertilizer

by R. P. THOMAS

The addition of micronutrients in today's fertilizer is a *must*. There are a number of reasons for this necessity. The industry is now using more concentrated major nutrient carriers, which naturally contain less micronutrients. Increased application of these concentrated fertilizers has produced greater crop yields and removed more micronutrients from the soil. Our soils contain less available trace minerals, yet these increased crop growths require more of them. As a result of this continuous drain on the nutrient level of our soils the farmers now have to use better business and management operations. Using the best in fertilizers is one of the necessary business management practices. The fertilizer industry is helping these farmers employ needed practices by manufacturing for them a better fertilizer—a more complete—a better balanced nutrient mixture, a super or "Premium Fertilizer".

The amounts of micronutrients used by the fertilizer industry today is anybody's guess. There is much evidence that the tonnage of trace element carriers used in fertilizer has increased several fold during the past decade. There are now many more suppliers of minor elements to the fertilizer industry than formerly. Several of these producers are reclaiming by-product materials which never get into any record of micronutrient uses. A very conservative figure of minor element carriers used with today's fertilizer is around 30,000 tons. Other conservative estimates are around 50,000 tons. The more optimistic guessers place the annual usage at 100,000 tons. Some of the micronutrient use estimators have included secondary plant foods, such as magnesium, in their guesses, and given figures as high as 200,000 tons per year.

In addition to a larger quantity of micronutrients mixed in today's fertilizer, the number of elements has increased from one or more to as many as a dozen. Fertilizer users of today are demanding in their fertilizer all of the essential and some of the beneficial elements. Many of the following trace elements may be demanded in today's "Premium Fertilizers": iron, manganese, zinc, copper, boron, molybdenum, cobalt, vanadium, nickel, barium, strontium, bromine, iodine, and even selenium.

These changing patterns of micronutrient demands are not in line with the recommendations of the college research and extension workers, since most of them are still recommending either no micronutrients or at the most only two or three elements. The more progressive farms are now demanding several of these minor nutrients in their fertilizers, if for no other reason than as an insurance against "Hidden Hunger". These demands are coinciding with the experiences of many agronomic and formulating leaders in industry. They noted that as soon as one trace element deficiency has been corrected by applying it with the fertilizer, another micronutrient shows as a deficiency in the plant. This pattern often continues until five or six minor elements are required to correct all of the deficiencies which develop during a crop season. Many of these progressive fertilizer users reported that it requires much less of any one of these trace nutrients in the fertilizer when there are several others contained in the fertilizer mixture. Such demands have led many in the fertilizer industry to add a general trace element mixture to their more productive and superior grades—"Premium Fertilizer".

Many micronutrient recommendations are for large quantities or sufficient amounts to last two or three years. This again, is in direct opposition to the reaction of these elements in the soil and in the way they are absorbed by plants. Micronutrients applied in large quantities either change to a less soluble available form, or produce concentrations which are toxic to the young, growing plants. Neither the producer nor user of fertilizer wants such conditions to happen in the soil. Plants are living things and require a variety of foods, the same as man and animals. It is doubtful if any of you would want to exist exclusively on only a single source of meat (protein-nitrogen) or even all meats for one month, or an energy food (carbohydrates-phosphates) for another month, or on regulatory food (vegetables-potash) for another month. Neither would any of you desire a diet of mineral foods (vegetable and seasonings—calcium, magnesium, etc.) for a month, or vitamins (fruits, juices, pills, etc.—trace elements) for still another month. We desire all of our food in a complete meal and so do plants. To provide such foods for plants, industry is now adding small amounts of many trace elements to their fertilizer mixtures.

A good fertilizer of today will supply some of all of the plant foods: the major nutrients, secondary and the micronutrients, or a balanced diet of some of all the essential and beneficial foods —or a fertilizer with a built-in insurance for good production. With the use of these properly formulated fertilizers a plant does not have to depend upon one root for one element and other roots for other plant foods to supply its nutrient needs. We have known for many years that a properly proportioned plant food will produce a better and more uniform crop growth. Minor elements are just one part of a good, properly balanced fertilizer —or "Premium Fertilizer".

A brief review of the advantages claimed by the users of "Premium Fertilizers" containing these trace elements will help in understanding their reasons for demanding such fertilizers. They report increased yields, improved quality, better keeping quality, lower moisture content, early maturity, more uniform maturity, additional protein, less insect damage and few disease problems. The use of trace element mixture often increases the yield

materially. Many of these reported increases are in excess of ten percent. It should be recognized that a one or two percent improvement in yield will pay for the micronutrients used. Such increases cannot be noted in field observations and are not statistically significant. However, the users report that such small gains may be quite profitable.

Research and extension workers have a tendency not to recommend the use of trace nutrients unless it has a Least Significant Difference (LSD) of 19:1 odds, or a 5% increase. These statistical differences are based on crop yields and not on cost of micronutrients. These LSD values do not consider other advantages obtained by the use of small amounts of trace elements. Such significant differences before favorable recommendations are out of line when compared to the additional cost of these premium fertilizers. These so-called significant differences were developed for the major nutrients. They are unrealistic for trace nutrients. Yield differences of such statistical magnitude for "Premium Fertilizers" represent several hundred percent profit to the user for the additional money invested in them. Some other methods of evaluating the results for micronutrient tests are needed. Let's encourage the better farmers in their leadership, not discourage them.

Often the yields from minor nutrient fed crops may be no better or even equal to the yield from the regular fertilizer treated crop; but still be more profitable. A lower moisture content in the micronutrient fed crop can greatly affect the final yield. A one or two percent drier corn or grain will usually pay for the increased cost of the "Premium Fertilizer". A 10% lower moisture for grain is common for users of "Premium Fertilizer". Many crop yields are increased by heavier weights of the market measure, such as bushel, bag, hamper, etc. These increased weights per volume often increase the price as well as quantity. These gains mean more profit at little extra cost.

Micronutrient fed crops have better maturity. More uniform maturity is often noted. This feature is very desirable to present-day growers, since they are being forced to use mechanical equipment for harvesting. Many vegetables, as well as general farm crops, are being harvested in a once-over operation by a mechanical picker. A 5% increase in more uniform maturity often means the difference between profits and losses. A twenty-five percent increase in uniformity of maturity is a common figure reported for the use of trace elements in a fertilizer. In addition to a more uniform maturity an earlier maturity is often reported. Such a factor may permit the harvesting of a crop before it is damaged by frost or carried into a rainy period.

Dr. Thomas, author of this article, is staff agronomist for International Minerals & Chemical Corp. This paper was prepared for and presented at a symposium on micronutrients at the meeting of the Fertilizer and Soil Chemistry Division of American Chemical Society, held in September. His talk precipitated many questions and discussions, with a clear separation between the reseachers — who prefer to detect and treat specific micronutrient deficiencies—and the industry men who believe in application of a mixture of micronutrients in mixed goods to eliminate potential limiting factors to crop production.

Other desirable quality factors, such as flavor, soundness, size, etc., produced by these "Premium Fertilizers", bring better prices to the growers. Many producers report better keeping quality of their vegetables and fruits when grown with minor elements. A two or three day longer period without breakdown in the product's quality often results in both a better price and a sale for the producer which would not be possible with a crop of lower keeping quality. It is also reported by many trace element fertilizer users that they have less disease and insect problems with this type of fertilizer. Since many fungicides contain minor elements in their chemical structure, such favorable results are to be expected. Micronutrients in a fertilizer will make the fertilizer more profitable to the user in many ways and further emphasize the well-known fact that fertilizers are one of the farmer's "Best Buys".

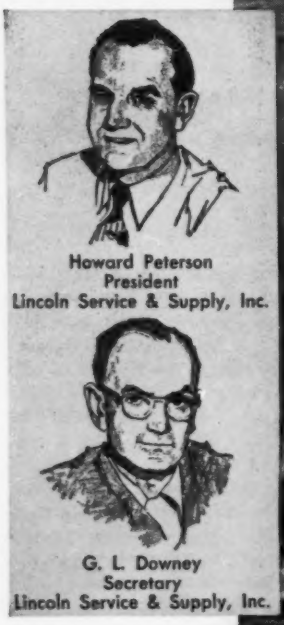
In hays and pastures the use of micronutrients increases the protein content of the animal feed. There are records which showed that protein may be grown for less than a cent a pound by using trace elements in fertilizer mixtures for these crops. Minor element mixtures in the fertilizer have also increased the total digestible nutrients (TDN) in animal feed. Many have reported that the animals prefer the crops grown with micronutrients. This leads to better gain as well as higher quality in the animal products. Both earlier-in-the-spring and later-in-the-fall pastures are experienced by the users of a good micronutrient containing fertilizer.

A better overall appearance of crops grown with a micronutrient fertilizer is often reported. There are probably several causes for these improvements in crop appearances. Many soils workers have indicated stimulating effects of micronutrients on the biological activities and enzyme action within the soil. As a result the soil becomes a better medium for root growth. Some micronutrient users have even reported a better physical condition in the soil from such improved root media. These better soil conditions may make the difference between a good harvest and a poor one.

Micronutrients are added to fertilizer in many forms by the fertilizer manufacturer. Since these types of carriers are being discussed by other members of the panel, they will only be briefly mentioned here. One of the simplest and cheapest sources of minor elements is the water insoluble carriers. These very finely ground materials approach the natural minerals in the soil. The composition of these carriers will depend upon the specific characteristics of the element. They are usually oxides, silicates and sulfate chemical forms. These colloidal carriers are dissolved by the mineral and organic acids in the soil. Seldom do they supply a high enough concentration of soluble salts in the soil to produce toxicity.

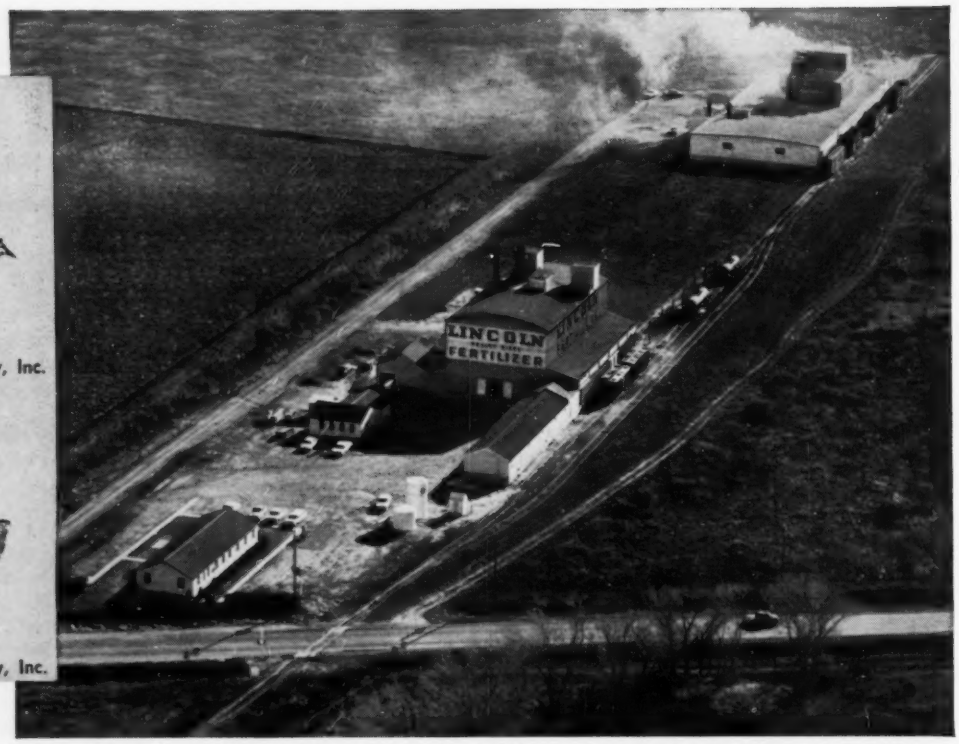
A second class of micronutrients is the materials which have been fused into a slag or glass. These types of materials are usually called "frits". They are finely pulverized before they are mixed into a fertilizer and added to a soil where the soil acids and microorganisms make them available to the plant roots. These types of carriers are probably one of the safest sources of trace elements. However, there have been reports that their solubility may be too low when the growing plant is making its greatest demand on the soil for some of these nutrients. They are often expensive.

A third class of micronutrient carriers is the water soluble salts. The sulfate form of these salts are used in the greatest quantity; however, there may be several other kinds of salts. Such materials are



Howard Peterson
President
Lincoln Service & Supply, Inc.

G. L. Downey
Secretary
Lincoln Service & Supply, Inc.



This modern plant at Grand Island houses the fertilizer manufacturing facilities of Lincoln Service & Supply, Inc., a long-time leader in the Nebraska fertilizer industry. Read how they control corrosion with SPENSOL GREEEN*:

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The modern Lincoln Service & Supply plant produces lawn and garden fertilizers in addition to their "Lincoln Pellet-Sized" agricultural brand. Among the first in the industry to make 15-15-0 and 10-20-0, they also led the way in application services by introducing bulk spreading in 1953. To supply the demand for direct application liquid nitrogen, they feature Spencer URA-GREEEN* Nitrogen Solutions. Their complete soil testing laboratory also provides another important service to farm customers.

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usually just finely enough divided to aid in mixing with the fertilizers. Some of these salts may affect the physical condition of the fertilizer and make it set up. These materials have the advantage that they are immediately available to the plant needs. On the other hand they may change quickly to unavailable forms in the soil. One of the disadvantages of these water soluble materials is that they may be so soluble that they are toxic to young plants. To prevent these potential toxic conditions there is a tendency of the formulator to cut down on the amounts and not add sufficient quantity to properly supplement the available nutrients in the soil.

The fourth form of trace element carriers are the chelates. Such carriers are produced by treating soluble salts with acids and chelates to form a protective structure around the metallic cations when they are brought into solution. These chelates are usually high molecular organic compounds. Such micronutrient carriers are immediately available to the plants. They are rather expensive. For the high pH soil and in liquid fertilizer, these chelate forms are the most satisfactory carriers of micronutrients.

Using these micronutrients in regular fertilizer mixtures presents some manufacturing problems. The very finely ground trace element mixture will increase the dustiness of the nongranular fertilizers. This dust is easily overcome by granulation. Neither the water insoluble or fritted mixtures interfere with pelleting of the fertilizer mixture. The water soluble and chelated mixtures may make the resulting fertilizer more hygroscopic and more difficult to handle and apply. There are some chemical reactions between the major nutrient carriers and the minor element mixtures. The amount of such chemical reactions depends largely upon the amount of moisture and free acid present in the mixtures. It is always difficult to mix small amounts of micronutrients into a fertilizer mixture. All of these problems in making a good "Premium Fertilizer" may be overcome by good plant management.

Summary

Micronutrients are being used more and more as a part of a mixed fertilizer, usually as premium grades. There is no accurate way to determine the exact amounts of these nutrients used in fertilizer. However, everyone seems to believe that micronutrient uses are increasing rapidly. The annual tonnage may be in six figures. The number of trace elements making up such mixtures is also increasing. Many minor element mixtures of today contain from 5 to 10 different elements. There is a growing tendency for the fertilizer user to demand micronutrients in fertilizer mixtures as a sort of insurance against "Hidden Hunger". The users of these fertilizers containing trace elements are demanding them because of yield increases, improved quality, better maturity, less insect damage and disease damage. The micronutrients in a fertilizer mixture have accentuated further the "Good Buy" of a fertilizer to the farmer. There have been no thorough statistical evaluations of the significance of micronutrient uses in fertilizers, especially in terms of profit to the farmer. Most LSD and percentage evaluations are based on yield for major nutrients and not on quality and other factors which makes such fertilizers profitable. There is need for a good method of evaluating the returns for premium fertilizers. The best results with these minor element mixtures are obtained when they are mixed with both the major and secondary plant foods. These micronutrient carriers are of many forms, such as water insoluble materials, fritted materials, water soluble materials and chelated carriers. Formulation of premium fertilizers present some manufacturing problems, but none which can not be corrected. Fertilizer manufacturers must now be concerned with major, secondary and micronutrient carriers in their products.

—of This and That . . .

——Just to show you that what's one man's meat is another's poison. Tom McCabe, Montgomery (Alabama) County Agent, works hard at getting two blades of Johnson grass to grow where only one grew before—to feed the county's some 90,000 head of cattle.

——In Olso, Norway, Sigvald Maartman-Moe, movie director turned industrialist, says he soon will begin producing fertilizer with a secret, 4000-year-old method developed by the Incas of Peru.

——Woodson Collier, who is Florida East Coast Fertilizer's oldest employe, has been with FEC since Nov. 30, 1925. He joined the company when it was only two and a half years old and has been in its employ continuously since that time. He has seen many changes in manufacturing at FEC and reminisces about the old 200-pound burlap fertilizer bags that had to be hand sewn. Back in those days, he was one of the fastest hand sewers in the business. Closing fertilizer bags is much easier now, he agrees, with an automatic sewing machine neatly doing the job. Also, automatic conveyors have replaced hand trucking. When asked how he felt about all the changes in the fertilizer industry, Collier said, "It's sure easier now than when I started and I'm glad because I'm not getting any younger." . . . In recognition of his 66th birthday and his long years of service to FEC, company president A. D. Fogle presented Collier with a gold-framed picture and plaque recently.

——Members of Operation "Bootstrap"—rehabilitation through education at the State Prison of Southern Michigan in Jackson—listed the following visitors in their spring bulletin: "Professor Richard Stinson, Michigan State University, Horticulture Department, East Lansing, recently was a guest lecturer for the combined Landscape Class and Bootstrap Garden Club. The topic of his talk was The Planting and Spring Care of Roses. While here Professor Stinson expressed amazement at the Rose Garden project that we have undertaken. He further offered suggestions on how we could make it an even more interesting and worthwhile project. Before leaving, he promised several more visits this spring . . . " Forest Shipman, The American Agricultural Chemical Company, Detroit, Michigan sales representative, paid our BOOTSTRAP Rose Garden a visit to survey our fertilizer needs. He also answered questions about fertilization that the Garden Club members asked. When asked about the best food for roses, the reply, "AGRICO!!" . . . "Carroll Vowels, Swift & Company, Hammond, Indiana, The Agricultural Chemical Division representative visited BOOTSTRAP and looked over our Rose Garden. He offered suggestions and promised to do what he could to help the project. Before he left, he presented us with a sample supply of VitoGRO to boost the lawn." . . . The foregoing gives a good idea of the fine help the Garden Club men at SPSM have had from industry people. The latest report says that the club's rose garden (within the walls of the prison) might well become one of the finest in the Mid-west.

Production demonstration:

LIQUID FERTILIZERS

from highly concentrated wet-process

PHOSPHORIC ACID

by
J. A. WILBANKS *and* F. P. ACHORN
Tennessee Valley Authority
Wilson Dam, Alabama

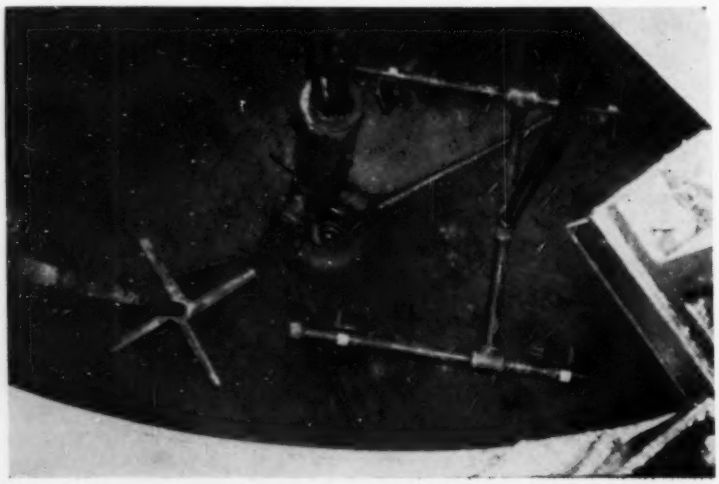
The Tennessee Valley Authority has been working experimentally on several processes to facilitate the use of wet-process phosphoric acid in the commercial production of liquid fertilizers since wet-process acid normally costs less than electric-furnace acid. One of the processes that has shown considerable promise involves the use of highly concentrated wet-process acid (*1*) containing about 70% P_2O_5. The phosphates in merchant-grade acid (54% P_2O_5) are present as orthophosphates. However, during concentration to 70% P_2O_5, about one half of the phosphates are converted to the nonortho form. The nonorthophosphates have a sequestering effect on the impurities in the acid, which prevents their precipitation when the acid is ammoniated. Also, the presence of the nonorthophosphates results in solutions of lower salting-out temperatures than solutions of the same grades made with acid containing only orthophosphate (*2*).

LABORATORY TESTS

Highly concentrated wet-process phosphoric acid from TVA pilot-plant operations (*1*) was used in laboratory tests of the production of liquid fertilizers of grades such as 10-34-0, 9-9-9, 8-16-8, and 7-21-7. These liquids did not salt out and remained essentially free of precipitated impurities during storage for 7 days at 32° F. or 30 days at 80° F. Most of the products contained finely divided carbon, which settled if allowed to stand undisturbed for several hours; however, this material did not form a hard cake and was easily dispersed by light agitation.

In other tests (*1*), the highly concentrated acid was used as a sequestrant with merchant-grade wet-process acid (about 54% P_2O_5) to produce liquids that contained little or no solids. The best results were obtained when these acids were fed separately and simultaneously to a reaction vessel during ammoniation. An 8-24-0 liquid in which 25% of the P_2O_5 was supplied as highly concentrated acid and the remainder as merchant-grade acid stored satisfactorily during the standard test periods (30 days at 80° F. and 7 days at 32° F.). In parallel tests, a satisfactory 8-24-0 liquid resulted when 20% of the P_2O_5 was supplied as electric-furnace superphosphoric acid (*3*). More of the concentrated wet-process acid was required because part of its nonorthophosphate content sequestered its own impurities.

Interior view of reaction vessel showing agitator, recirculation line, and ammonia sparger.



PLANT-SCALE TESTS

The use of highly concentrated wet-process phosphoric acid in the production of three-component liquid fertilizers (5-10-10 and 14-7-7 grades) was demonstrated in tests made in a commercial liquid fertilizer plant. The acid was prepared by concentrating commercial merchant-grade acid (approximately 52% P_2O_5 grade acid (approximately 52% P_2O_5) in a TVA pilot plant to about 71% P_2O_5. The highly concentrated acid was much more viscous than merchant-grade acid (10,200 vs. 69 centipoises at 80° F.), but no difficulty was encountered in pumping it at a temperature of about 65° F. with a piston pump. The formulations for the 5-10-10 and 14-7-7 liquid fertilizers are tabulated as follows:

	Pounds/ton	
	5-10-10	14-7-7
Acid (71% P_2O_5)	282	197
Aqua ammonia (23.4% N)	252	176
Urea—ammonium nitrate solution (32% N)	129	451
Urea (45% N)	---	210
Potassium chloride (62% K_2O)	323	226
Water	1014	740
	2000	2000

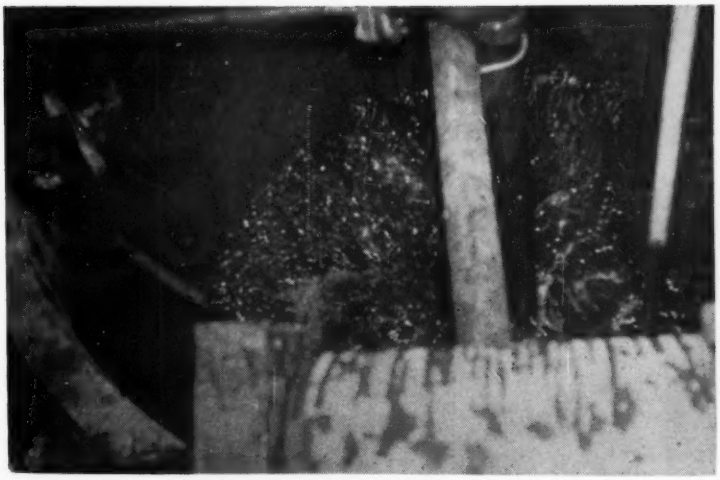
The acid was neutralized with aqua ammonia. Urea—ammonium nitrate solution was used as a source of supplemental nitrogen in producing both grades. In the 14-7-7 grade, solid urea was added to decrease the proportion of ammonium nitrate and thus obtain a lower salting-out temperature than would have resulted if only the solution had been used. The urea was a conditioned commercial product, which was the only type available. The 2% by weight of water-insoluble conditioner caused no difficulty in handling and application of the liquids to the soil. The use of unconditioned urea (46% N) is preferable, however, to prevent difficulties that might result from settling of the conditioner in storage equipment.

The procedure used in producing these liquids was as follows: Enough water was added to the 1000-gallon reaction vessel to permit good agitation, and this water was ammoniated slightly by adding about 5 gallons of aqua ammonia. Then the acid, the remainder of the aqua ammonia and water, and the other materials were added simultaneously. The first portion of water was ammoniated as a safeguard against conversion of the nonorthophosphate in the acid to the ortho form by hydrolysis. Care was taken to feed the acid and aqua ammonia so as to maintain an approximately neutral solution (pH 6.0-6.6). At a lower pH, hydrolysis of the nonorthophosphate could be significant and sequestration of impurities would be decreased.

In other tests, highly concentrated wet-process acid was used in the production of an ammoniated base solution at the TVA fertilizer research center, and this solution was shipped to a commercial plant where it was used in the production of 8-16-8 and 7-21-7 liquid fertilizers.

At right—Applying 8-16-8 grade liquid on fescue.

Below—Applying 7-21-7 grade liquid on orchard grass and ladino clover.



Producing a batch of 14-7-7 grade liquid.

The base solution was made by feeding the concentrated acid, anhydrous gaseous ammonia, and water simultaneously to a small reactor at such rates as to maintain a pH of about 5.8. The solution had the following analysis:

N	% by wt. Total P_2O_5	Ortho P_2O_5	Ortho P^2O^5, % of total P_2O_5	pH	Specific gravity at 80° F.
9.3	33.0	19.3	58.5	5.8	1.394

The formulations for the 8-16-8 and 7-21-7 liquid fertilizers were:

	Pound/ton	
	8-16-8	7-21-7
9.3-33.0-0 base solution	970	1273
Urea—ammonium nitrate solution (30% N)	233	72
Potassium chloride (62.5% K_2O)	256	224
Water	541	431
	2000	2000

These products were made by a cold-mixing procedure: The water, base solution, urea—ammonium nitrate solution, and potassium chloride were charged to the reactor in the order named. The ambient temperature was 90° F., and the estimated temperature of the raw materials was about 80° F. The temperature of each product 5 minutes after the addition of the potassium chloride was about 67° F. All of the potassium chloride was in solution within 5 minutes.

All the products contained small amounts of finely divided carbon, which settled when allowed to stand undisturbed for several hours. However, this material did not form a hard cake and dispersed readily when the liquid was pumped from the storage tank.

Application

No difficulties were encountered in the application of the products. The 14-7-7 and 5-10-10 liquids were applied to the soil under cotton seed at a rate of about 600 pounds per acre with conventional application equipment. The 8-16-8 was broadcast on fescue at the rate of 300 pounds per acre through 3D-Delevan spray nozzles. The 7-21-7 was applied on orchard grass and ladino clover at the rate of 500 pounds per acre with a broad jet spray.

Acknowledgment

Acknowledgment is made to James L. Woodall, Manager of the Fertilizer Division of Mississippi Federated Cooperatives, Inc., Jackson, Mississippi, and to Dan C. Hutson, Owner and Manager of the Hutson Chemical Company, Murray, Kentucky, for their assistance in making these tests.

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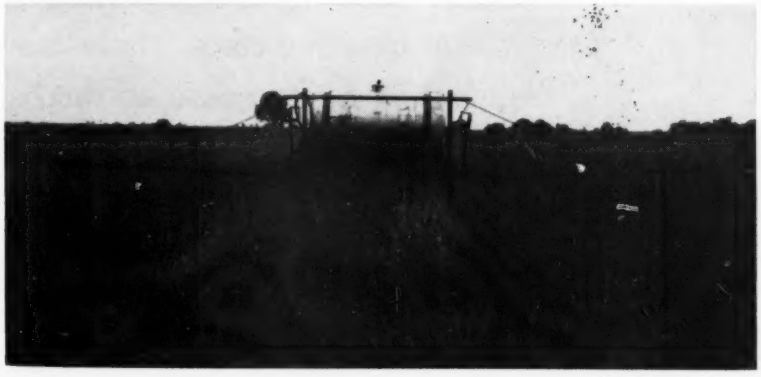

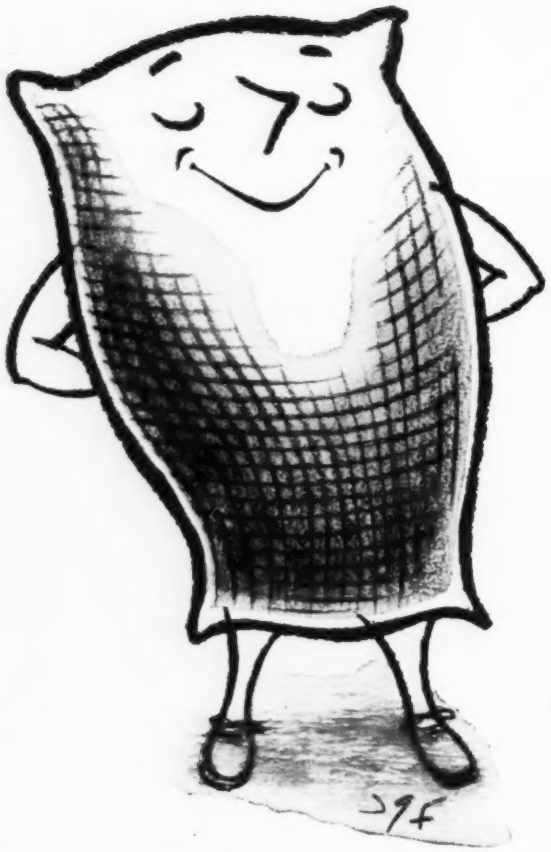

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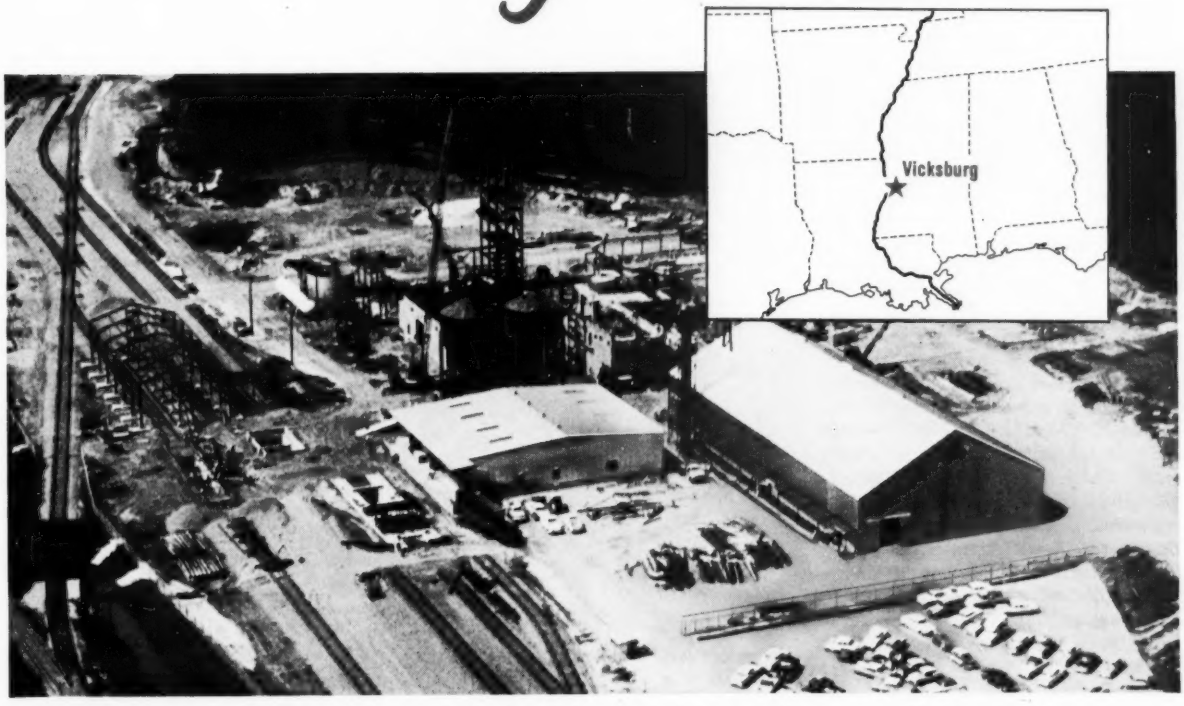

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Thirsty People, Thirsty Plants

Two decades of liquid fertilizers for California growers

by GEORGE P. GRAY

The people of California have recently voted for a $1.75 billion bond issue to insure that neither the people nor their plants will suffer from thirst. While this great thirst quencher, par excellence, has been amply provided for, many people have shown a great desire for beverages much stronger, more potent than water. Plants, too, are being treated to strong drinks by their farmer pals.

Consumption of strong drinks by the people of California is shown in the 1959-1960 annual report of the State Board of Equalization. It is shown by tax collections that they consumed more than 230 million gallons of beer and 56 million gallons of wines and distilled spirits.

In the past few years farmers have been plying their plants with strong drinks in the form of liquid fertilizers more and more each year. In the late 20's liquid fertilizers came into use to some extent on California farms. Soluble fertilizers, however, did not become of great commercial importance until much later. WESTERN FERTILIZER HANDBOOK, published in 1953, by the Soil Improvement Committee, California Fertilizer Association, recognized their worth by this statement: "Liquid fertilizers, when properly used, have proved to be very efficient and today have a definite place in plant feeding".

The Bureau of Chemistry, California Department of Agriculture, in its 1940 annual report, included an analysis of a liquid fertilizer when only 235 tons were sold. From then on, the increase in sales has been spectacular.

By 1950 sales had increased to 36,390 tons. For the year 1960, the bureau reported sales of 483,106 tons. This tonnage is more than one-third of the total sales of all commercial fertilizers that year, 1,275,463 tons.

Sales in 1960 were 31,000 tons less than in 1959. It remains to be seen whether that decrease in sales indicates a definite trend or only a normal fluctuation. Future reports of the Bureau of Chemistry will determine that point.

The author, who wrote this article especially for this issue of COMMERCIAL FERTILIZER, *can speak with authority on his subject. Now retired, his former positions include: assistant professor at University of California College of Agriculture, chief of the Division of Chemistry for California Department of Agriculture, soil scientist for Pacific Guano Company, and senior chemist for U. S. Department of Agriculture.*

Table 1. Reported Sales of Liquid Fertilizers in California, 1960

Fertilizer	Analysis	Tons
Anhydrous Ammonia	82- 0-0	96,653
Ammonia-Ammonium Nitrate Solution	40- 0-0	10,579
Ammonia Solution	20- 0-0	226,402
Ammonium Nitrate Solution	20- 0-0	34,904
Calcium-Ammonium Nitrate Solution	17- 0-0	9,525
Fish Emulsion	10- 5-5	847
Liquid Phosphoric Acid	0-52-0	11,339
Mixed Fertilizers, Liquid		92,857
		483,106

SEMI-ARID SOILS DEFICIENT IN NITROGEN

Ammonia solution (aqua ammonia) was sold in greatest amount in 1960 of any of the liquid fertilizers. This tonnage was exceeded only by total sales of dry mixed fertilizers.

The very large use of ammoniacal solutions and dry ammonia salts in the semi-arid West is accounted for by the fact that the soils there are predominately on the alkaline side. Ammonia compounds produce an acid reaction in the soil after decomposition by bacteria and thus lower the pH.

Then, too, such soils are notably deficient in nitrogen. So some form of nitrogen, whether it be ammoniacal, nitric or organic, is required in most cases for satisfactory production of crops. Ammonia and its salts are the cheapest form of nitrogen so this fact, too, is a very important contributing factor in the large use of ammonia and its compounds.

Many of these soils, perhaps the majority of them, are well supplied with available phosphate and potash. So nitrogen is usually of first importance here. More and more soils of the West, however, are being found where application of phosphate or potash is a paying proposition.

SIMPLES AND MIXES

The three major plant foods are available in solution for use singly by drilling in, broadcasting, in sprinklers or irrigation water. Anhydrous and aqua ammonia are the ones most widely used singly except in sprinkler application. Solutions sold in the greatest amount in California are shown in Table 1.

Most any analysis wanted by the grower is to be had in liquid form. Analyses range from the so-called "complete" fertilizers to nitrogen and phosphates; nitrogen and potash; ammonia and nitrate nitrogen; ammonia, nitrate and organic nitrogen.

OBSERVATIONS BY MEN OF THE INDUSTRY

Correspondence and conversations with executives of the state's fertilizer industry have disclosed some definite conclusions about future trends in consumption of liquid fertilizers and have pointed out certain advantages and disadvantages in their use.

REASONS FOR INCREASE

Harry M. Pierce of Chemical Fer-

Figure 1. It is estimated that at least 90 percent of liquid fertilizers are drilled in.

tilizer Co., Inc., says, "While I feel liquid usage will continue to grow, it is my personal opinion that the increase will be less spectacular as growers find need to return to a more balanced program and away from cheap nitrogen. Low prices of liquid nitrogen combined with ease of application has been responsible for this trend. (*Increase in use of liquids.*)"

Dr. G. F. McLeod of Niagara Chemical Division, Food Machinery and Chemical Corporation, feels the same way as does Mr. Pierce about cheap nitrogen. He says, "The rapid increase in use of liquid fertilizers is, in my opinion, due to the cheapness of aqua ammonia and the fact that the chemical industry is applying it for the growers."

Pro and Con

Certain advantages and disadvantages are pointed out by men of the industry. Dr. McLeod: "The prime disadvantage of liquids, other than liquid ammonia, is undoubtedly the cost when related to the amount of plant food obtained. The advantages are ease of handling, particularly insofar as weight is concerned."

G. R. Hawkes, agronomist for California Chemical Company, writes: "Some advantages of liquid fertilizers are ease of handling in the field, versatility of formulations, adaptation to water run application, less man power to apply.

"One disadvantage is cost of equipment for handling (pumps, tanks, applicators), which are much more expensive than dry fertilizer equipment and require custom applicators in the field. This may or may not be a disadvantage depending upon the applicator.

"Another disadvantage is the cost of materials. These materials must be soluble to be in solution and the (highly) soluble salts are generally more expensive than the less soluble salts.

"High analysis materials of N, P_2O_5 and K^2O became difficult to formulate since the total amount of salts held in solution is limited. The salting out temperatures become such that cold weather prohibits their use."

If the application is made at temperatures above the salting out point no trouble will be experienced. Suppliers have charts showing the effect on salting out of various formulations at different temperatures and offer advice to users on this point.

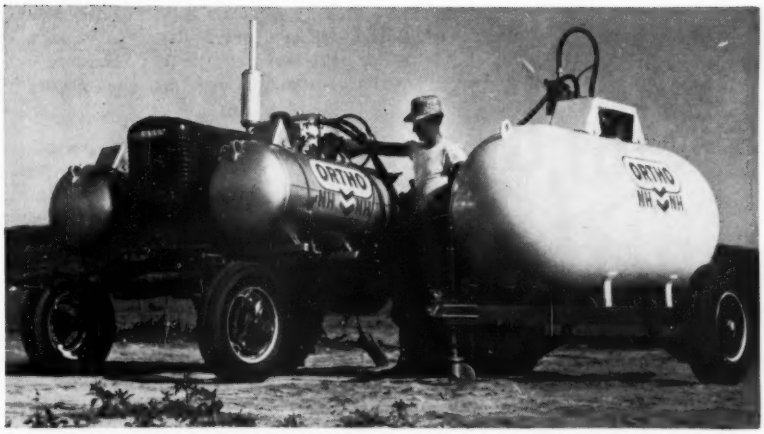


Figure 2. Delivering ammonia from a 500-gallon tank directly into smaller tank mounted on grower's tractor for field application.

Application

It is estimated that only 10 percent of liquid fertilizers are applied by sprinklers, in irrigation water and broadcasted. At least 90 percent is drilled in. (See figures 1 and 2.)

It is the custom, to a considerable extent, to ship concentrated fertilizer materials to a convenient locality where they are mixed according to the desired formula, then transported to the field for application. This represents a great saving in cost over shipment of the diluted product from the manufacturer's plant to the field.

An idea of the magnitude of the liquid fertilizer business in California may be had by considering the equipment of one of the larger firms supplying these commodities. This firm has the capacity to manufacture 300 tons of anhydrous ammonia per day. Reinforced steel tanks provide storage, under refrigeration, of six million pounds of this 82-percent nitrogen material. A fleet of 7500-gallon portable storage tanks is used to make deliveries to distributors. Each unit carries its own elevating and blocking equip-

Figure 3. Leg tank for delivery of nitrogen solution through specially designed injector into irrigation water in grower's field.

Figure 4. Equipment such as these Ortho ammonia tanks for field use meter out concentrated plant foods into irrigation water.

ment, its own gasoline-drive pump and a meter that automatically prints sales tickets showing the amount pumped out. (See Figure 2.)

Potential Labor Savers

While the amount of liquid fertilizers applied through sprinklers and in irrigation water is small, this use may be a contributing factor in increasing use of liquid fertilizers in the future. A specially-designed injector is available for such use. (See Figure 3.) Plant foods such as diammonium phosphate, urea, urea-ammonium nitrate solution, ammonium sulphate and others are available for such use. So a grower can fertilize while irrigating with practically no extra expense. Neither anhydrous nor aqua ammonia are advisable for use in sprinklers on account of evaporation losses.

Another potential labor saver is use of urea as a foliage spray. It has been shown that this soluble, 45-46 percent nitrogen fertilizer is capable of being absorbed directly through leaves, stems and bark of plants. It is compatible with most insecticides. So, mixed with an insecticide, it can serve a triple purpose when sprinkler-applied: in irrigation, fertilization and in insect control.

Plants' tolerance to foliage-applied urea varies with the kind of plant and with climate. So it is advisable for growers to make some tests in a small way before large scale use.

Liquid Fish

Liquid fish fertilizers, sold under various brands, find favorable use primarily on potted plants and in home gardens. Some are straight fish products containing 5 percent organic nitrogen and small amounts of other plant foods. Some are fortified with urea and with phosphate and potash up to 5 percent of each. These excellent fertilizers are especially useful for non-agricultural use. Danger of burning from overuse on house plants and home gardens is minimized.

The straight fish product is that portion of raw sea fish that is water soluble. It is concentrated to a thick emulsion to insure stability. One gallon contains the liquified water soluble essence of over 200 pounds of raw fish according to Renz Mezara of Atlas Fish Fertilizer Co. It is difficult to entirely remove the fishy smell so a masking perfume is added.

This commodity is marketed in small containers but, even so, reported sales in 1960 were 847 tons. That amount filled many ½-pint, quart and gallon containers.

Use on Organic Wastes

Efforts are being made by experiment stations and the forest industry to improve the agricultural value of the millions of tons of wood waste, sawdust, bark, shavings, etc., now being wasted by burning.

Figure 5. These tanks are transported empty by small truck or tractor and established at dealer delivery stations. Once located, the units are blocked to relieve tires of weight. Each unit carries its own elevating and blocking equipment under tank, and is also equipped with its own gasoline-driven pump as well as a meter that automatically prints sales tickets with the number of gallons pumped out during each delivery. At each temporary location these portable tanks are filled from highway trailer tankers operating from Calspray's Richmond and Modesto manufacturing plants.

Nitrogenous solutions, as well as dry material, are useful and economical for large scale treatment of wood waste. One method is to spray such solutions on wood waste as it passes along on a conveyor system. A rotating cylinder has been used for this purpose.

The treatment hastens decomposition by stepping up the nitrogen content of the waste, amply supplying the need of decomposing bacteria. In a similar way, nitrogenous solutions, as well as dry materials when wetted down, are useful in the preparation of compost piles of straw and other organic wastes.

Mr. Hawkes observes, "Some liquid formulations have not proven to be agronomically equal to the dry fertilizers of the same plant nutrient content. More work is being done on this at many experiment stations. This is not a general finding but seems associated with specific formulations such as liquid phosphoric acid."

There is a place in agriculture for both liquid and dry fertilizers. So there seems no likelihood that the liquids will largely supplant use of dry materials. In some cases one kind may be preferable. Extensive irrigation practices in California, almost universal need for nitrogen, cheapness of liquid nitrogen, ease of application are all contributing factors in the wide acceptance of liquid fertilizers in California.

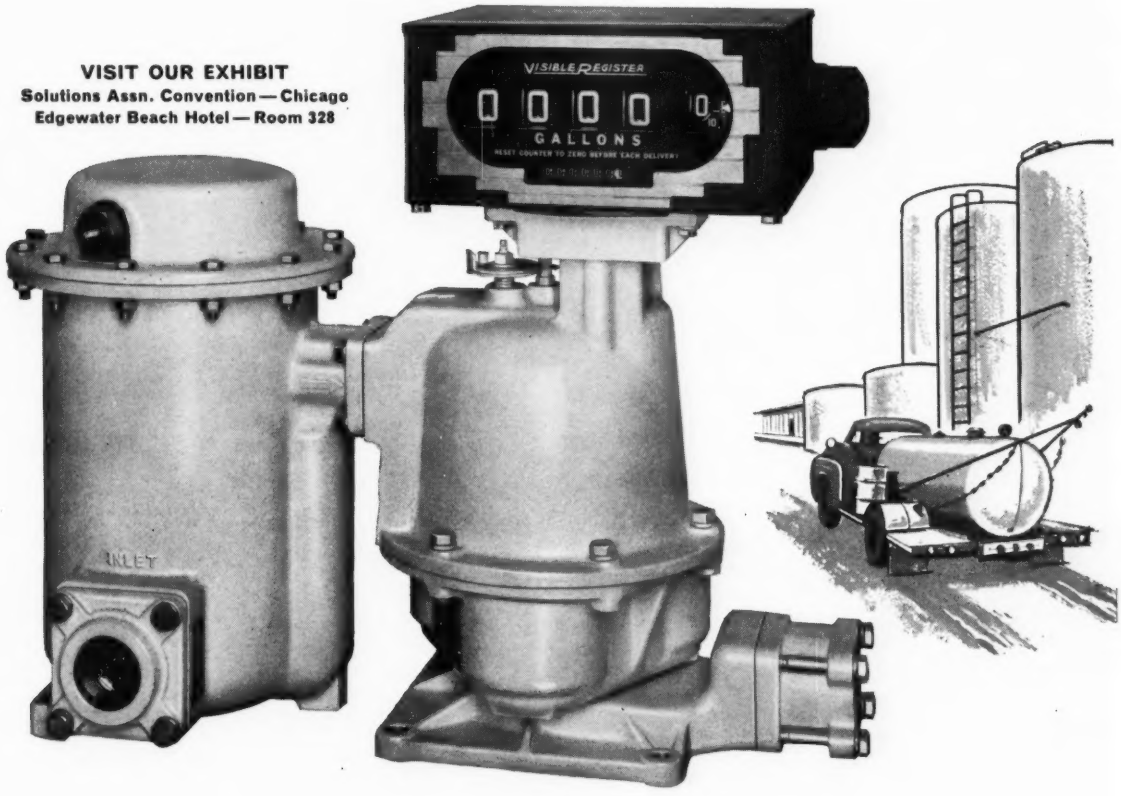
Acknowledgements

The author's acknowledgement with thanks is made to D. W. Galbraith of Agriform Chemical Co., Inc. and to G. R. Hawkes of the California Chemical Company, Ortho Division, for furnishing the illustrations of this article.

TOKHEIM
MODEL 684 LF
METERS

Guardian of your profits

VISIT OUR EXHIBIT
Solutions Assn. Convention — Chicago
Edgewater Beach Hotel — Room 328



Accurate measurement can mean the difference between making money and losing it. You can have faith in the accuracy of Tokheim meters for several reasons. They are designed and built to handle fertilizer solutions by a veteran meter manufacturer. They are the positive piston displacement type; accurate at any speed and at any pressure. Use of stainless steel, Rulon, and other non-corrosive materials makes this meter highly resistant to wear. Delivery speeds up to 60 gallons per minute. Ideal for use at mixing plants, on nurse tanks, or field applicators. Equipped with 10,000 gallon counter; 1,000,000 gallon totalizer. Air release and ticket printer optional. Inlet and outlet tapped for 1½″ pipe. A guaranteed value!

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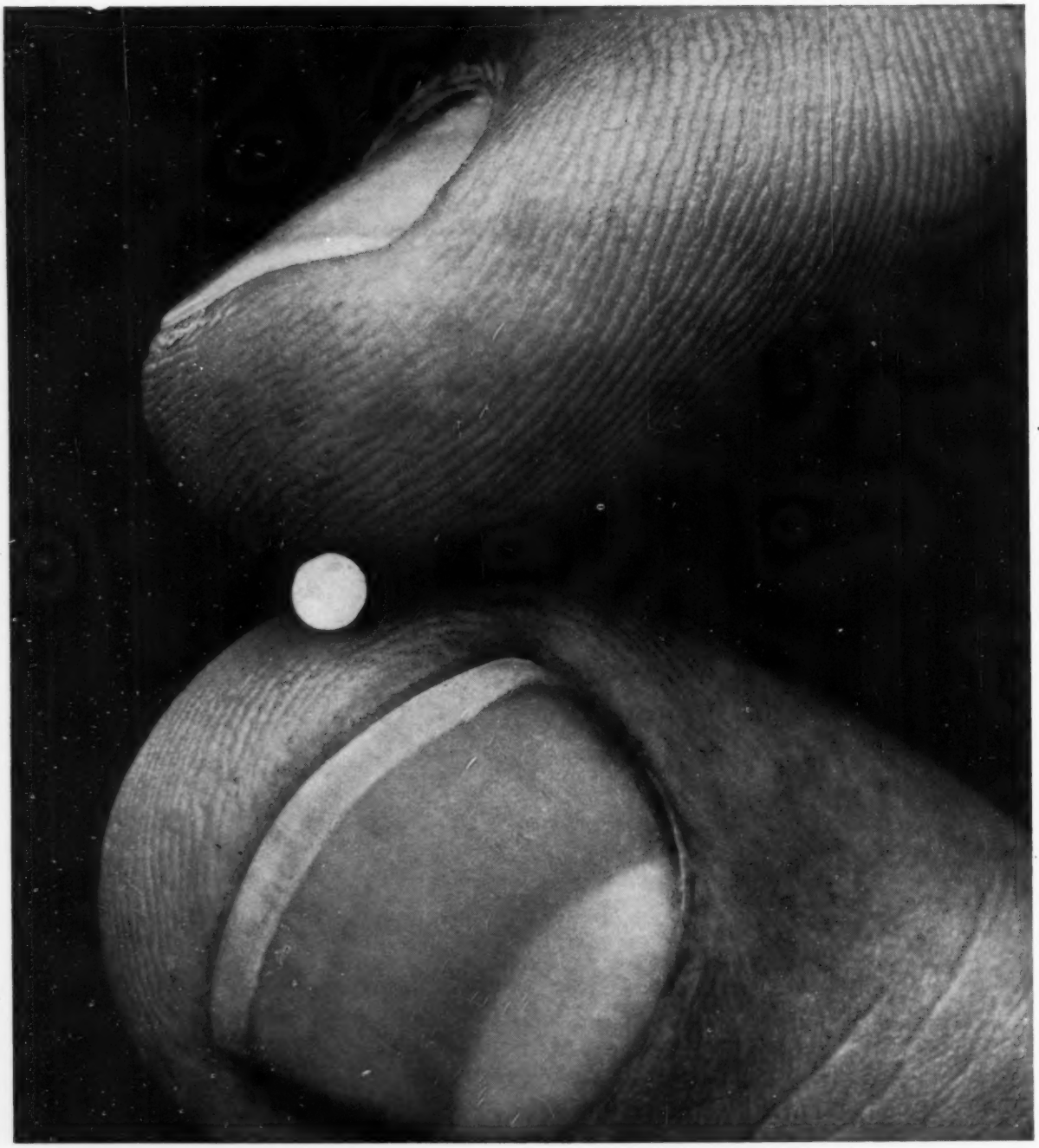

From little urea prills big fertilizer profits grow

This remarkable urea prill, produced by Cobalez of Belgium, is probably the most economical and efficient source of solid nitrogen material available in the world today.

Belgian urea prills give you a guaranteed 46% nitrogen. The price per unit of nitrogen is comparable with competitive solid materials. What's more, the nitrogen is concentrated in a compact, uniform unit. Result? Excellent distribution. Easier handling. Substantial savings on transportation and storage.

Belgian urea prills are uncoated, yet so skillfully made they contain less moisture than coated material. They're free flowing; there's no dust problem. And you get maximum solubility (you can dissolve 880 pounds in 100 gallons of water at 68°F.).

Is it any wonder H. J. Baker goes 3,000 miles to get them?

You can buy Belgian urea prills in America right now. In quantity. With fast delivery assured. As the first step in seeing how much better they can do the job for you—and how much bigger they can make your profits grow—send for a free sample and complete information. Simply write to the H. J. Baker office nearest you.

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Est. 1850

by WALTER J. SACKETT, SR.

The author is vice president of The A. J. Sackett & Sons Company, a firm specializing in designing, building, and equipping fertilizer plants. This paper, presented at the 1961 meeting of the Fertilizer and Soil Chemistry Section of American Chemical Society in September, is an up-to-date report on the process which he described at a recent session of the Fertilizer Industry Round Table.

A closer look at the

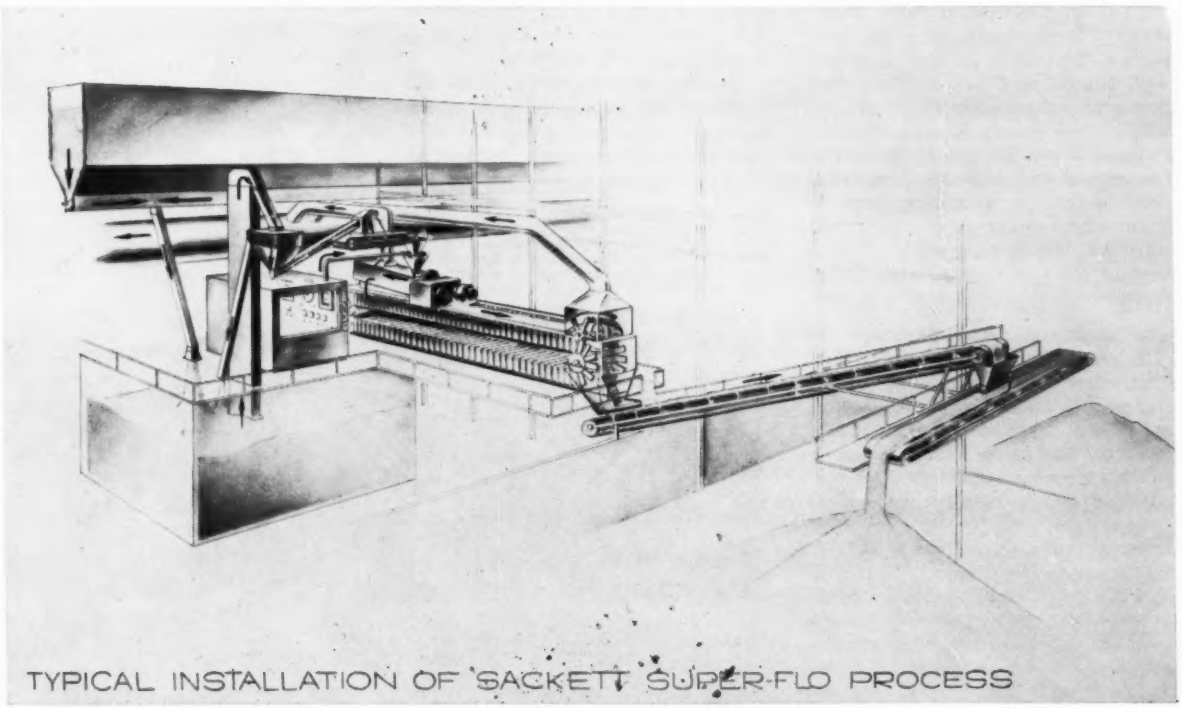
Super Flo Process for Superphosphate

The *Super Flo* Process was conceived and developed to fill an industry-wide need for producing a superphosphate of improved quality. Prior to the inception of continuous acidulation, batch methods were universally used, and the superphosphate produced by them left much to be desired, both from a standpoint of quality control and flow characteristics. One can readily understand that quite some variations in chemical results were to be expected with the batch systems, when one considers the fact that the weighing of the ground phosphate rock and sulphuric acid had to be done manually at the pan mixer where working conditions, due to the escapement of obnoxious fluorides, made this task a very difficult one, indeed.

Because there was a complete lack of control over the rate of flow at which the rock and acid came together in the pan mixer, there was a wide range of reactions varying from over-acidulated portions to under-acidulated portions of the rock. Indeed, had it not been for the use of a den, into which each charge from the mixer was dropped, the lack of chemical control would have been intolerable. These inaccuracies were, to a large extent, averaged out at the time of excavation by clam shell bucket or other mechanical means. Control of the obnoxious fluoride fumes was a serious problem, because of the sudden and violent liberation of these pungent vapors as each batch was charged into the mixer. Then, too, with the batch system, production had to be halted each time the den was filled to permit the removal of superphosphate.

The *Super Flo* Process, on the other hand, is a highly automated continuous method with all the inherent advantages of having the in-process materials combined under controlled conditions, and with the resultant uniform liberation of the fluoride gases. This continuous process overcomes many of the shortcomings and disadvantages of the batch methods with respect to operating costs, fume control, and product quality and uniformity. First, I shall give you a brief word description of the *Super Flo* Process, after which I shall describe each phase in more detail.

Pulverized phosphate rock is continuously and accurately weighed



TYPICAL INSTALLATION OF SACKETT SUPER-FLO PROCESS

and delivered to a T.V.A. type blending cone, where it is introduced into swirling streams of metered sulphuric acid and water. The resultant slurry is then kneaded and vigorously agitated in the puddler located beneath the blending cone. Upon being discharged from the puddler, the material flows into the solidifier, which provides sufficient residence time for the mass to solidify on its way to the point of discharge. A cutter is employed to reduce the solidified cake into a friable mass, from which point it is transferred to storage. The fumes generated during the process operation are drawn off through an exhaust system connected to the puddler and solidifier housings.

Now, to come back and give you a detailed description of this process:

Ground Phosphate Rock Control System

Starting with pulverized phosphate rock in an elevated supply hopper, we use an inclined screw conveyor of special design and with variable speed drive to provide rock feed to a continuous belt-type scale. This conveying system is equipped with anti-flushing devices. Into this scale, which, incidentally, is of the constant belt speed type, we have incorporated a sensing device, which ends its signal to the hydraulically-operated speed changing device controlling the feed screw, for more or less feed to satisfy the requirement of the scale. The balance, or position, of the scale beam is at all times indicated on the central panel board through a multi colored pilot light system. The scale is also provided with a totalizing device which importantly contributes to the inventory control system. Upon being discharged from the scale, the accurately weighed flow of pulverized rock enters a gathering hopper, from which point it is discharged into the blending cone for initial contact with the acid and water flows.

Liquid Metering System

Sulphuric acid at a normal concentration of approximately 60° Baume is pumped from storage and metered through an instrument located on the control panel and piped in such a manner that it is discharged tangentially into the blending cone or funnel. Water for tempering or diluting the acid to the 57° to 58° Baume range is similarly arranged and discharged into the same blending cone in a tangential manner. Positioning the discharge of both the acid and water in a tangential manner plays an important part in generating a high speed swirl of these two liquids in the blending cone in the direct path of the ground phosphate rock as it is discharged from the continuous weighing machine. We prefer to meter the sulphuric acid through a magnetic type instrument, which gives us better control should the acid contain a substantial amount of entrained solids. This meter is equipped with a recording instrument as well as totalizing device for checking-out the acid inventory.

Reaction and Product Flow

The *Super Flo* Process gives optimum reaction by accomplishing the acidulation in two distinct phases. First, in the blending cone where the initial contact is made and, again, in the puddler, which provides the secondary and final intimate mixing of the in-process materials. This two stage acidulation with its more intimate contact achieves a more completely converted product. The slurry resulting from the combining of rock, acid and water, flows from the blending cone into the puddler. In this machine the final acidulating action takes place, and the fluorine vapors are exhausted.

The now-thickening slurry discharges from the puddler and flows into the solidifier which is a slow-moving channel-like conveyor made up of a series of roller chain-mounted U shaped steel sections. This unit is of sufficient length as to permit a mass retention time of approximately 30 minutes, during which time the slurry is transformed into a solid substance. The solidifier is equipped with a variable speed drive for greater flexibility. One hour or more retention is possible.

As the now-solidified mass approaches the discharge end of the solidifier, it comes in contact with the cutter or excavator, which reduces the cake into a friable material by its shaving action prior to its being taken to storage. This cutter is of a rotary helical design with replaceable teeth of stainless steel. A complete system of electrical interlocks is an integral part of the process, which system is triggered by the centrifugal relay located on the rotary cutter. If for any reason the cutter should fail to maintain its normal operating speed, this interlock system will automatically shut down the complete process. In this way, serious production delays and damage to the equipment are avoided. This significantly aids the operator stationed at the central control panel.

Fume Removal System

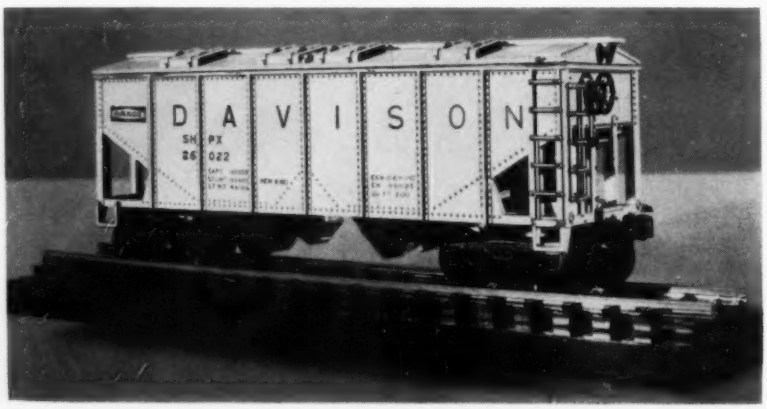
Extreme care has been exercised in designing the fume control system. The entire process from the puddler to the cutter is completely enclosed and is under constant suction for removing the evolved vapors to the fluoride recovery plant. All of these housings, as well as the fume ducts, are provided with Bonded Neoprene linings for protection against corrosion.

In conclusion, the *Super Flo* Process offers the following advantages:

1. *Lower Manufacturing Costs* . . . through substantial savings in labor, power and maintenance expense.
2. *Higher Quality Product* . . . through more effective dual acidulating method and higher conversion of end product.
3. *Improved Fume Control* . . . through elimination of surge reactions.
4. *Process Flexibility* . . . through *Super Flo's* ability to produce enriched and triple superphosphate, as well as the normal superphosphate.

MODEL CAR IS SALES TOOL

To remind customers of the advantages in carload orders of Hi-Flo Triple Superphosphate, W. R. Grace & Co. Davison Chemical Division has had a scale model made of the covered hopper cars used to ship their fertilizer material. A replica extending to small details, the top of the car comes off to reveal a sample of the triple superphosphate. The model was made by the Varney Co. of Miami, a manufacturer of miniature railroad systems, comes on rails fixed to a substantial plantform, and is useful as a paper weight.



New Style H Dura-Bukets-- the profitable way to elevate fertilizer

Distributorships available in choice territories.

Here are FIVE BIG REASONS why the all-plastic Style H DURA-BUKET puts new savings into your commercial fertilizer production —

1 WON'T CAKE
The slick walls and rounded corners of the DURA-BUKET prevent fertilizer build-up. DURA-BUKET is **self-cleaning.**

2 WEIGHS LESS
Each DURA-BUKET weighs only 2½ lbs. This is a weight reduction of 924 lbs. on a 100-bucket elevator . . . and that means **longer chain life.**

3 WON'T CORRODE
The special DURA-BUKET plastic is unaffected by metal-eating fertilizer chemicals. DURA-BUKETS **stay** in service.

4 RESISTS ABRASION
Resilient plastic "gives" under impact of heavy loads of sharp, tough particles. This elasticity prevents cutting.

5 CUTS OVER-ALL COSTS
A DURA-BUKET keeps operating while other types are being cleaned or replaced. You save not only bucket costs, but avoid expensive down-time as well.

For full details on cost-saving DURA-BUKETS, write to:

Dura-Buket DIVISION

NATIONAL OATS CO. • EAST ST. LOUIS, ILLINOIS

NUMBER 3 IN A SERIES OF 3 REPORTS

FILLING THE NEED FOR PHOSPHORUS

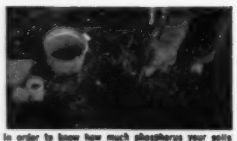
American Cyanamid Company completes the phosphorus story with facts about the need for—and the results of—phosphate fertilization

The October and November reports† explained why phosphorus is an indispensable plant food; phosphorus fixation and how to make it work for you; why yearly phosphorus fertilization is needed by most crops.

This final report locates areas of phosphate deficiency and shows how crops respond to phosphate fertilization.

We're using up the phosphate reserves in our soils

Each year an average of about 3 lbs. of phosphorus is removed from U.S. soils for each 2 lbs. returned.



In order to know how much phosphorus your soils need, you must know how much they have. Soil testing is the way to find out.

This deficit is consistently greater in some soils. For example, most pastures receive only a fraction of the phosphorus they need . . . if they get any at all. On the other hand, intensively cultivated crops such as vegetables, tobacco, and potatoes, get more than they can use. This over-ferti
crops over ma
a surprising r
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can explain thi

**How phospha
got the**

Early America
ing virgin soils

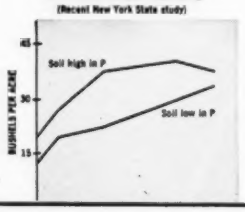
†If you missed these r

phosphorus, soon learned that phosphate fertilization increased yields. By 1900, phosphates had become the major fertilizer used.

After decades of fertilization and cropping, many—*but not all* trated in the top few inches of soil. This encourages shallow rooting and retarded growth in dry years. Efficient production demands adequate available phosphorus *throughout* the root

never seen a pound of phosphate fertilizer. Forage crops respond as much as cash crops, and often give a greater return per dollar invested in phosphorus, other plant nutrients, and lime.

HOW GRAIN RESPONDS TO PHOSPHORUS AND LIME
(Recent New York State study)



phosphorus is "fixed" soils after application lizer. But, when soils erly managed, fixed pl can be made available Thus, like money in t phosphorus in the soil ...but can be released t increased income – ju capital investment.

Where do we go fro

Production is growing efficient through contri all phases of agricultu crop varieties, irriga management, etc. Hc chain is no stronger weakest link. Efficien ited by the *weakest* ma

NUMBER 2 IN A SERIES OF 3 REPORTS...

PHOSPHORUS FERTILIZATION

American Cyanamid Company presents facts which will help you with phosphate fertilization

Last month's report† explained why phosphorus is the "indispensable" plant food; why only a small part of the phosphorus in your soil is usable by crops as plant food; how phosphorus quickly becomes "tied up" or "fixed" by forming compounds from which phosphorus is unavailable to most plants; and what you can do to make the phosphorus in your soil more available to your crops.

The present report discusses phosphate fertilization — when and how to apply phosphate fertilizers.

ply is used *during the year of application.*) As total phosphorus in the soil increases, so does the amount that is available to your crops . . . *if you manage your soil properly.* Eventually, enough phosphorus can accumulate so that the amount converted from the fixed forms will be enough to supply a good share of the annual crop needs. Where, before, larger amounts of phosphorus fertilizers had to be applied to get enough available phosphorus to crops, now smaller amounts will do, because much of the phosphorus requirement will come

tration of available phosphorus to get crops off to a good start. Later, when root systems are better developed and able to absorb more phosphorus, the crops will be able to get enough phosphorus from these well-supplied soils.

Timing and placement of phosphorus fertilizers

Phosphorus fertilizers are applied to increase *available* phosphorus for the coming crop and to build up the total phosphorus in soils with low phosphorus reserves.

Available phosphorus is quickly fixed in many soils. In

tilizers *in bands.* By ing the fertilizer n phosphorus is not as as when mixed thro Also, crop roots rea phorus more quickl of the fertilizer is the young plants. placement is more acid and other "high low in phosphorus.

On the other ha stay in for two ye must have their a supplied by top dr phosphates top-dr surface of the soil at inch or two of the so move into the root fore, for hay and p such as alfalfa and it is important to ap amounts of phospha *them into the plow soil* when the seed pared. This extra su

NUMBER 1 IN A SERIES OF 3 ARTICLES...

PHOSPHORUS...

American Cyanamid Company explains the problem of getting enough of this indispensable plant food ...and what to do about it

Every crop needs nitrogen, phosphorus, potassium, and other elements. Each crop needs these elements in a certain proportion. Different soils supply differing amounts of these plant foods. Therefore, the amount to be supplied by fertilizer will vary, depending on soil type, the amount of plant food already in the soil, and other factors. That's why fertilizer manufacturers offer such a wide range of mixed fertilizers. American Cyanamid Company believes the best way to get the most from your fertilizer program is to understand each plant food . . . what it does and how to use it.

Numbers tell percentages of nitrogen, phosphorus (P_2O_5), potash (K_2O) in mixed fertilizer. The ratio depends on crop need and amount of nutrient in soil. Article discusses problem of phosphorus fertilization.

This is the first of three articles* in which Cyanamid presents

has a different job and a deficiency of each produces its own special symptoms.

When plants don't get enough phosphorus, growth slows; roots are stunted and not properly branched; blossoms, fruits and seeds don't develop properly. Yields are low, and often maturity is delayed.

In livestock, phosphorus is part of many body processes, such as conversion of feed to energy and formation of strong bones and teeth. Animals on phosphate-deficient feed and forage develop depraved appetites (they will actually chew bones), and will dissolve phosphorus from their own bones to supply enough for other body functions.

Purpling of leaf edges reveals serious phosphorus deficiency. Growth and fruiting are slowed, yields cut long before these symptoms show up.

plants can't take up sufficient nitrogen or potash for high yields.

Another way in which phosphorus increases availability of nitrogen is in legumes. Legumes take free nitrogen from the air and convert it to plant food . . . if they are first supplied sufficient phosphorus!

Why phosphorus fertilization is a problem

There's an average of 1000 lbs. of

Plant roots take up most of their nutrients from the soil solution. *That means most plant food entering the roots must be dissolved in soil water.* Yet, over 99% of all phosphorus in the soil is insoluble in water. It is part of many complex compounds and has become "tied up" or unavailable to plants. Soil scientists call this process "phosphate fixation." Less than 1% is phosphorus that is readily available to plants!

How phosphorus is "tied up"

Phosphorus is a very "active" element. That's why it's never in pure form in nature, and why it so quickly forms many complex compounds with other elements in the soil. If you handle your fertilizer and soil building program properly, you can actually make available more of the phosphorus "tied up" in the soil or applied in fertilizers. If you mishandle soils and fertilizers, you can speed phosphorus fixation. While you can legitimately consider "tied up" phosphorus as "stored" in the soil, it can be released only by proper management.

What to do to make more phosphorus available

Here are some of the things you can do to make available more of the phosphorus you already have . . . and that which you add in fertilizers.

Liming — A most important fac-

Local and regional fertilizer manufacturers are linked to this program by a listing in the last column of each advertisement. These advertisements will be put into booklet form, and made available for distribution by manufacturers and dealers. If you wish a supply, please write for details.

A FERTILIZER PROMOTION PROGRAM OF MAJOR IMPORTANCE TO THE INDUSTRY

In these three advertisements—appearing in *Farm Journal* and *Progressive Farmer*—American Cyanamid Company sets forth the role of phosphorus, and explains how best to handle soils and fertilizers for adequate phosphorus nutrition.

As a major producer of phosphates for fertilizer, we're mindful of two important facts: *One*—the prosperity of the entire agricultural community, including its suppliers, depends on how well America's land is farmed; *Two*—America's phosphate reserves are *not* inexhaustible. Cyanamid hopes these reports will contribute to both *sufficient* and *efficient* use of phosphates in a well-balanced fertilizer program. The advertisements are summed up this way: "Use enough pounds of fertilizer... and get the most from every pound you use."

We believe that only *methodical effort* to increase general understanding of fertilizers can bring total fertilizer usage up to *recommended* levels.

American Cyanamid Company, Agricultural Division, Princeton, New Jersey.

CYANAMID

PHOSPHATE PRODUCTS

CYANAMID SERVES THE MAN WHO MAKES A BUSINESS OF AGRICULTURE

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These fertilizer manufacturers use Cyanamid phosphate products* in their quality mixed fertilizers:

PHOSPHORIC ACID—This high-analysis, liquid phosphate is being used in increasing amounts by manufacturers of high-analysis fertilizers. Direct application uses also are being developed.

There are other sources of fertilizer phosphates, but they are less widely used.

Which phosphate fertilizer should you use?

Most likely, most of the phosphate fertilizers you apply to feed your crops will be mixed fertilizers, rather than straight phosphate materials. The analysis of the fertilizer you buy is shown on the bag or attached tag. The important thing to you is the amount of *available phosphate* the analysis guarantees (usually given as P_2O_5). The source makes

These fertilizer manufacturers use Cyanamid phosphate products* in their quality mixed fertilizers:

too alkaline, unavailable compounds are formed with calcium.

Soil acidity is measured on the "pH scale" from 1 to 14. As the soil pH goes below 7, soils are acid; higher than 7, alkaline. The ideal pH range for most crops is from 6 to 6.5. In this range, phosphorus is most available. Thus, in highly acid soils, liming alone increases the phosphorus available to crops.

Organic matter—Liming releases phosphorus in another way. Some unavailable phosphorus compounds are "organic."

PHOSPHATE CONTAINED IN HARVESTED CROPS

CROP	YIELD PER ACRE	LBS. OF P_2O_5 REMOVED
CORN (grain)	100 bu.	35
(stover)	2 tons	15
WHEAT (grain)	40 bu.	15
(straw)	1.5 tons	5
OATS (grain)	80 bu.	20
(straw)	2 tons	15
ALFALFA	4 tons	40
SOYBEANS	2 tons	30
TIMOTHY	2.5 tons	25
CABBAGE	30 tons	30
POTATOES	400 bu.	30
TOMATOES	15 tons	30
COTTON (seed and lint)	1500 lbs.	20
(stalks, leaves & burs)	3000 lbs.	10

These organic compounds in crop residues are constantly being broken down by bacteria, and this process releases soluble phosphorus. Bacteria are not very active in acid soils. Lime reduces acidity, increases bacterial activity and thus the supply of available phosphorus.

The plow-down of cover crops

These fertilizer manufacturers use Cyanamid phosphate products* in their quality mixed fertilizers:

products:
phate Rock
Superphosphate
economical
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Princeton,
American
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CALIFORNIA

California Chemical Company has announced that construction is underway at the Ortho Richmond fertiizer plant on a new warehouse building for storage and bagging of ammonium sulfate.

D. L. Barton, chief engineer for Ortho Division, says the warehouse will be built with tilt-up concrete panel walls, and will contain about 26,000 square feet of floor space (20,000 for bulk storage of the ammonium sulfate and 5,400 for the bagging operations). The bulk storage section will be 80' wide x 260' in length and the bagging room will be 60' x 90'. The bagging room will be equipped with facilities for loading both trucks and rail cars.

The project is scheduled for completion by March, 1962.

FLORIDA

Escambia Chemical is making good progress with the new Pace plant, which is planned to produce 20,000 annual tons of urea. The output will not, as presently planned, be in solid form, but will be used for ammoniating solutions and solutions for direct application. The plant is expected to go into production early next year.

* * *

International Minerals and Chemical have a huge new dragline at the Achan mine, which is expected to go into use in January. It will have a 35 cubic yard bucket, and the boom is 225 feet long. They call it "Master Miner" —a name suggested by the wife of H. P. Moore, office services supervisor — and chosen from among 350 suggestions offered by company personnel.

* * *

Armour is involved in much expansion in their potash area. A large section of Lake Hancock shores is being readied for mining, to feed Fort Meade and to be available, if needed to also supply the Bartow facility. A 35-cubic yard Bucyrus-Erie dragline is on order for this installation.

The full Armour expansion program in Polk County has been estimated at $30,000,000 but officials, without defining the precise figure, have said this is "a little generous".

IDAHO

Simplot has completed moving the ammonium phosphate plant from Anaconda, Montana, to Pocatello and it is in production.

ILLINOIS

National Phosphate's new plant at Marseilles is under construction. Leonard Construction of Chicago has started building the contact sulphuric unit, which is expected to have a capacity of 750 daily tons of sulphuric acid, using elemental sulphur as raw material. Design is Leonard-Monsanto. The plant is part of National's multi-million dollar expansion program. This facility is to be completed in some eight months from now.

INDIANA

Landmark Farm Bureau Cooperative (See Changes) plans to build a $20,000,000 nitrogen plant near Terre Haute to produce anhydrous ammonia, ammonium nitrate, N solutions and urea products. A major portion of the output will be marketed in the Illinois-Indiana-Ohio area served by the regional cooperatives that make up the membership of the new corporation: Landmark; Illinois Farm Supply; Indiana Farm Bureau; Central Farmers Fertilizer.

K. N. Probasco, Columbus, Ohio, is executive vice president and general manager of Landmark.

IOWA

Vorhes Chemical Corp., Charles City, has bought a property in Clarksville, and is remodelling it to install a fertilizer plant which is due to be in production around the first of the year.

LOUISIANA

Armour has begun construction on a new fertilizer manufacturing facility just west of Lake Arthur, on Louisiana Highway No. 14, according to an announcement by H. Vise Miller, vice president and general manager of the Fertilizer Division.

The fertilizer facility, which has an annual capacity of over 20,000 tons, will provide complete dealer service, with a complete line of Armour fertilizers in bulk and bagged form. It will make available mixed fertilizers as well as fertilizer materials.

The new plant will be a part of the company's New Orleans Division, under the supervision of J. G. Reames, New Orleans division manager, Mr. Miller said, and will be in full operation for the 1962 spring fertilizer season.

NEW YORK

Niagara Chemical Division of FMC has announced the first post-emergence herbicide "safe to use on tomato crops" —which is said to pave the way for field seeding and mechanical harvesting of this crop. Niagara has begun work in their new pesticide research unit, with the finest of equipment. It is an 18,500 square foot laboratory and greenhouse at Middleport.

NEW MEXICO

Kermac Potash Co. is building a plant to turn out 1599 daily tons of potash at Carlsbad. It is a joint subsidiary of Kerr-McGee of Oklahoma City and National Farmers Union Service Corporation of Denver. A pilot plant is being used to work out design and engineering details at Kerr-McGee's laboratory at Golden, Colorado. Our readers will remember that Phillips Petroleum, formerly a part owner of the Farm Chemical Resources Development Corporation, holder of the reserves involved, sold out their interest to the other two last Spring. Kerr-McGee will be operating partners.

TEXAS

Campbell Fertilizer Co., Houston, has started a major expansion at its plant, J. A. Tennant, president, announced last month. Claude Everett Construction Co. is the general contractor for the $47,000 expansion program.

The first step of the program was completed with the erection of a

new 4000-square-foot warehouse building.

Tennant said new facilities to be completed in the near future include a 3700-square-foot addition to the plant and another 2400-square-foot warehouse.

Campbell, which manufactures a line of organic base fertilizers, anticipates national distribution of several new products within the next six months, Tennant said.

WASHINGTON

Westward Ho, Centralia, has been organized with $50,000 capital to mine peat and manufacture fertilizers. Incorporators: Kurt A. Heinold, John B. Larson and Mervin F. Paulson.

WYOMING

American Humates, Inc., having secured a loan from two Small Business Investment Corporations, has built and will soon get under way with their plant at Glenrock. They will purify humic acid into a fertilizer product to be marketed as Aqua Humus. J. C. Karcher is president of American Humates and of Concho Petroleum Co.

ARGENTINA

Albright & Wilson Ltd., Great Britain, and Villa, Aufricht of Buenos Aires reportedly have entered into an agreement for the establishment of a phosphoric acid plant in Argentina. The British firm will supply equipment and technical aid for the plant which presumably will be operated by Villa, Aufricht. Production is expected to begin early next year.

BELGIUM

Cities Service has bought a substantial interest in the Belgian ammonia plant owned by Evence Coppee & Cie, which gives them expanded access into the growing chemical field of the European Common Market.

CANADA

Cyanamid of Canada, Ltd., is reported to be planning new facilities for the production of diammonium phosphate and granular triple superphosphate at its Welland, Ontario, Canada site. Expansion of the company's ammonia plant at this location also is planned.

* * *

International Minerals & Chemical has made a loan with Prudential Insurance —$40,000,000 for a 20-year period, which will be used to complete expansion, retirement of long-term debt, and cash to support increasing sales volume. Their plant at Saskatchewan is expected to come in next Summer with 420,000 annual tons of potash, which will be boosted to 1,200,000 tons by early 1963 through the $10,000,000 expansion program now underway.

Other plans include $3,200,000 for the Florida diammonium phosphate plant and $4,000,000 for the expansion and cost reduction program in the phosphate mining and processing facilities there.

ENGLAND

Fisons has awarded contract for design and erection of the mechanical components of their compound fertilizer granulating plant at Ipswich.

GREECE

A new superphosphate plant is to be erected at Kavalla in Northern Greece to produce materials with a P_2O_5 content of 55,000 tons per year. An existing facility at Drapetzone-Piereas is to be modernized and will have a similar capacity. The project is being financed with help from the National Bank and support of the French company St. Gobain.

HOLLAND

Delta Chemie, wholly owned subsidiary of three very large Dutch farm cooperatives, has come to an arrangement with Montecatini to take part in the operation of their year-old plant near Rotterdam, at Vlaardingen. Delta will in return interest itself in the Montecatini subsidiary, Neerlandaise de l'Azote, on the Holland-Belgian border, also a fertilizer manufacturer.

INDIA

Trombay equipment and machinery for ammonia, urea and nitric acid production will be supplied by Chemical Construction Co., New York under a $19,800,000 contract.

* * *

Andhra Sugars, Ltd., Venkalarayapuram, Tanuky, West Godavari District, Andhra Pradesh, has been awarded license for establishment of a fertilizer plant at Kothagucliam, to produce urea only, with annual nitrogen capacity of 80,000 tons.

* * *

East India Distilleries, Ltd., Madras, is establishing a small fertilizer plant at Ennore (Madras), which, when completed about middle of 1963, will have annual capacity of 8,250 tons of nitrogen in form of ammonium sulphate. British firm, Simon Carres, building plant, and Commonwealth Development Finance Co. providing a £600,000-loan (£1=US $2.80).

* * *

Jolan Bros., Jolan House, 62, Ballygunge Circular-Rd., (1 Rainey Park) Calcutta 19, has been granted license for establishing fertilizer plant in Rayasthan, subject to foreign collaboration being acceptable to Government. Firm now engaged in discussions with Vitro Engineering Corp. of New York.

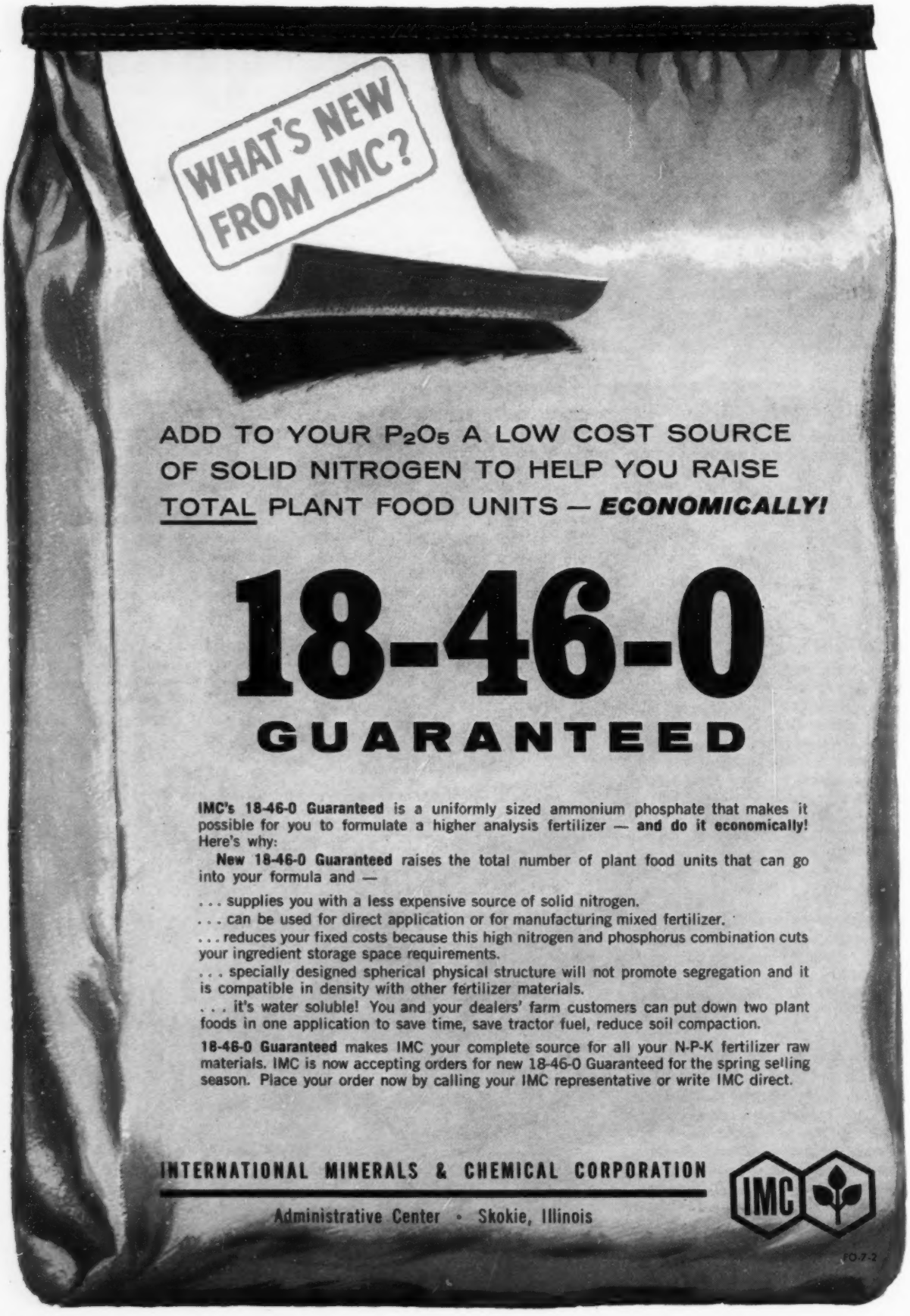
* * *

Khandelwal Bros., Ltd., 33 Nitaji

(Continued on page 55)

CANADIAN INDUSTRIES USES 'PORTABLE WAREHOUSE'

Feeding time for a bulk fertilizer spreader. From the 20-ton 'nurse' truck on the right, fertilizer is being blown through the pipe to the spreader truck, which has a capacity of seven tons. This system, developed by the agricultural chemicals division of Canadian Industries Limited at Chatham, Ont., speeds up custom service by reducing the time spent by the spreader truck in hauling fertilizer from the plant. With a large mobile source of supply —in effect, a sort of travelling warehouse— the spreader's capacity is doubled.


WHAT'S NEW FROM IMC?
ADD TO YOUR P_2O_5 A LOW COST SOURCE OF SOLID NITROGEN TO HELP YOU RAISE TOTAL PLANT FOOD UNITS — ECONOMICALLY!
18-46-0
GUARANTEED
IMC's 18-46-0 Guaranteed is a uniformly sized ammonium phosphate that makes it possible for you to formulate a higher analysis fertilizer — and do it economically! Here's why:
New 18-46-0 Guaranteed raises the total number of plant food units that can go into your formula and —
. . . supplies you with a less expensive source of solid nitrogen.
. . . can be used for direct application or for manufacturing mixed fertilizer.
. . . reduces your fixed costs because this high nitrogen and phosphorus combination cuts your ingredient storage space requirements.
. . . specially designed spherical physical structure will not promote segregation and it is compatible in density with other fertilizer materials.
. . . it's water soluble! You and your dealers' farm customers can put down two plant foods in one application to save time, save tractor fuel, reduce soil compaction.
18-46-0 Guaranteed makes IMC your complete source for all your N-P-K fertilizer raw materials. IMC is now accepting orders for new 18-46-0 Guaranteed for the spring selling season. Place your order now by calling your IMC representative or write IMC direct.
INTERNATIONAL MINERALS & CHEMICAL CORPORATION
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FO-7-2

Subhas Rd., Calcutta, has been licensed to establish fertilizer plant at Madhya Pradesh, and is reportedly negotiating with U.S. firm, Hydro Carbon Chemicals of Newark, N. J. with view toward collaboration.

* * *

Gorakhpur, the largest fertilizer plant under the Third Plan, with an estimated capacity to be 80,000 annual tons in terms of nitrogen, is likely to have the collaboration of Japanese technicians in its development.

* * *

Assam is under way, with preliminary work in process. A British credit of £30,000,000 has been allocated for the project, which will be based on natural gas from the Nahorkatiya oilfields.

MALAYA

The Fertilizer Corporation of India has agreed to give technical advice in the establishment of a fertilizer plant in Malaya and training personnel at Sindri. The purpose: "to profit from India's experience . . . and thus avoid mistakes . . ."

MEXICO

Fertilizantes del Istmo S. A. has gone into production with its 150 daily ton nitric acid and its 200 daily ton ammonium plants in Vera Cruz. A total of six plans will make up this complex. Still to be added are plants for production of urea, sulphuric acid, phosphoric acid, and one on high-analysis fertilizer. Mexico expects, beginning next year, to save $24,000,000 annually through its own fertilizer production.

PAKISTAN

Fenchuganj Fertilizer Factory is expected to be in production within three months. It is expected to produce urea at Rs 100 less per ton than imported fertiliser, according to the Industries Minister.

SAN SALVADOR

Fertilizantes Central America is expected within the next three months to break ground for the $5,000,000 plant at Acajutla, which is to be completed in 18 months and to produce ammonium phosphate, ammonium sulphate and a complete line of fertilisers.

SWITZERLAND

U. S. Industrial Chemicals has opened at Baar a new laboratory designed primarily for polyethylene research service to the customers of USI.

facts to help you sell

Operators of family farms, like other businessmen, need good records.. No longer can the typical operator of a family farm rely on his memory to provide necessary information about his business, which is becoming increasingly complex.

A systematic and convenient method of accounting for farm transactions can afford much information useful in successful farm management.

On most family farms such records may be kept by the farmer or someone in his family, without the expense of hiring an accountant or bookkeeper.

In setting up an accounting system for a farm, a first consideration is to decide what is wanted from the records to be kept. Some farmers may not wish to go beyond the records necessary for an accurate preparation of income tax returns.

Others may want to keep a detailed record for each crop or livestock enterprise.

For a majority of family farms a system of record-keeping based on the five kinds of business records listed below is recommended.

Documentary Records —These are legal papers, such as business agreements, leases, contracts, deeds of title, mortgages, and insurance policies.

Balance Sheet —An annual statement of farm assets and liabilities for current use and historical analysis.

Sales and Purchase Records —A systematic account of farm sales and purchases, recorded as they occur.

End-of-Year Summary —A summary of the year's transactions, for use in business analysis and as a basis for income tax reports.

Production Record —Crop and livestock records of production and production requirements that will enable the farmer to estimate production efficiency by enterprises.

Such a system of records and accounts should provide a basis for computing net income and equity in the business and for preparing income tax returns.

The records can also be used for finding the strong and weak points in the farm business. They will not solve problems automatically, of course; the extent of their value depends on how the information from them is interpreted and used.

Useful tips on how to keep farm business records are included in a new publication, "Family-Farm Records," Farmers' Bulletin 2167. To obtain a copy of this publication, write to the Office of Information, USDA, Washington 25, D. C.

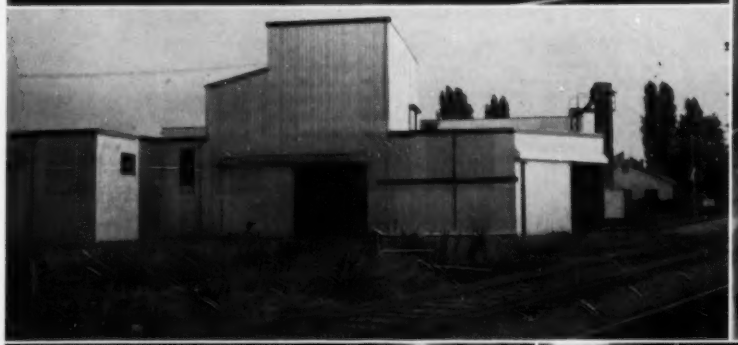
Smith-Douglass Annual Report Wins Prize

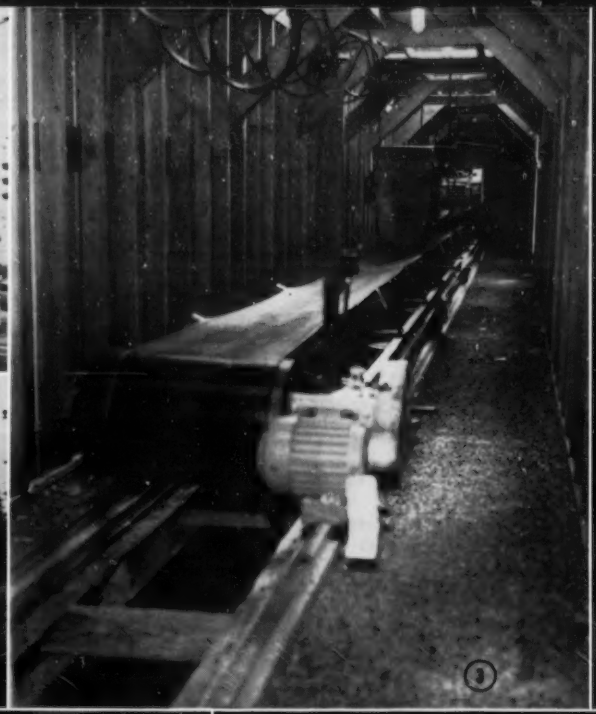
Smith-Douglass Company has been selected for a third-place award among 31 entrants, for its annual report to stockholders in the small chemicals industrial classification in the 21st Annual Report Survey sponsored by "Financial World," national weekly magazine. A certificate was to be presented to Smith-Douglass treasurer and controller S. L. Lott at an awards banquet in the grand ballroom of the Statler Hilton Hotel in New York City.

Obituaries

Archibald H. Rowan, 82, who, until his retirement served in New York as board chairman of the American branch of Albatros Superfosfaatfabriken, and who had been 1920-1940 director in London of the Phosphate Export Association, died of a heart attack in Princeton, N. J., September 22.


BRACKMAN-KER

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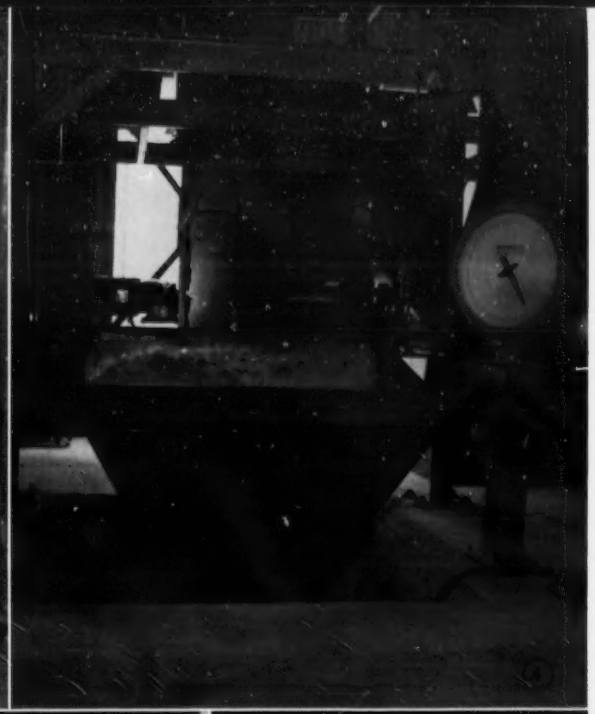


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New Canadian producer —

Brackman-Ker Mixing Plant Will Supply Company's Stores

Dry mixing facility features simplicity, provides one-man weighing and mixing

←KEY TO PICTURES ON PAGE 56.

1. Brackman-Ker Farm Store at Langley, B. C. Farm and home needs tastefully displayed in show-room at left. Warehouse for grain and feeds at right. Fertilizer plant can barely be seen projecting back of retail store.

2. Portion of fertilizer plant. Elevator at right takes raw materials from under-track unloading conveyor and elevates to belt conveyor to storage bins.

3. Fixed and shuttle belt conveyors deposit raw materials in storage bins beneath.

4. One-ton suspension hopper scale. Has air cylinder operation of discharge gate. Tractor shovel operator deposits formula weights of various raw materials until complete batch is assembled.

5. Mixing unit, showing hopper scale, elevator, tailings mill, 1-ton mixer with pneumatic controls and discharge elevator to bagging unit. Note location of air controls for scale valve, mixer intake valve and discharge door. Tractor shovel operator can operate entire unit from his position on machine, making a one-man weighing and mixing operation.

6. Penthouse view of elevator from batching scale, Stedman Type S-46 screen and portion of product elevator taking mixer discharge material to surge hopper over bagging machine.

7. Stedman Model RO 1-ton rotary batch mixer, pneumatic controls on intake valve and discharge door. 15 HP-TEFC gearhead motor.

8. Richardson automatic bagging machine. Brackman-Ker are using polyethylene bags which will be closed by heat sealing. Closing equipment had not arrived when this photo was taken.

Brackman-Ker Milling Company, which has its head office at New Westminster, British Columbia in southwestern Canada, officially opened its new fertilizer mixing plant at Langley, B. C. September 18.

This is the first venture into fertilizer mixing for the company, which serves its customers through a chain of farm stores strategically located in the Fraser River Valley. The stores offer a wide range of products required by farmers and home gardeners.

The new fertilizer and allied chemicals operations are under the management of E. R. McCrady. R. S. Hazlewood is plant superintendent.

Several groups of fertilizer producers from nearby Washington and Oregon toured the plant during the first few days it was in operation.

The plant is located on a site immediately behind the modern Brackman-Ker Farm Store showroom at Langley, and alongside the grain and feeds warehouse which adjoins the store.

Design features of the fertilizer plant were centered around simplicity, accessibility, and high performance with minimum manpower.

Brackman-Ker expects the plant not only to provide greatly improved service to their customers in the Langley area, but also to stock its other farm stores from this centrally-situated location.

An under-track unloading conveyor brings in fertilizer materials from hopper cars on the rail siding to a bucket elevator, which lifts them to an overhead system of fixed and shuttle belt conveyors for distribution into the storage bins.

Materials are retrieved from the bins by tractor shovel, and elevated to a one-ton suspension hopper scale with an air cylinder-operated discharge gate. The tractor shovel operator deposits formula weights of each raw material until the complete batch is assembled.

Materials are passed through a Stedman Type S-46 screen on tailings mill before being discharged into the mixing unit.

The mixer, a Stedman Model RO 1-ton rotary batch unit, is powered by a 15 HP-TEFC gearhead motor. It is equipped with pneumatic controls on intake valve and discharge door. Mixer controls are situated so that the tractor shovel operator can manipulate them from his position on the tractor, affording a one-man weighing and mixing operation.

From the mixer, an elevator takes the product to a surge hopper above the Richardson automatic bagging machine. The goods are packaged in polyethylene bags, which are closed by heat sealing equipment.

Stedman Foundry and Machine Company, Inc., Aurora, Indiana, provided the layout and design of the Brackman-Ker plant to fit into an existing building. Stedman also furnished the major portion of the equipment. All of the installation, except wiring and lighting, was done by Brackman-Ker employees.

Another Quality Product for the Fertilizer Industry . . .

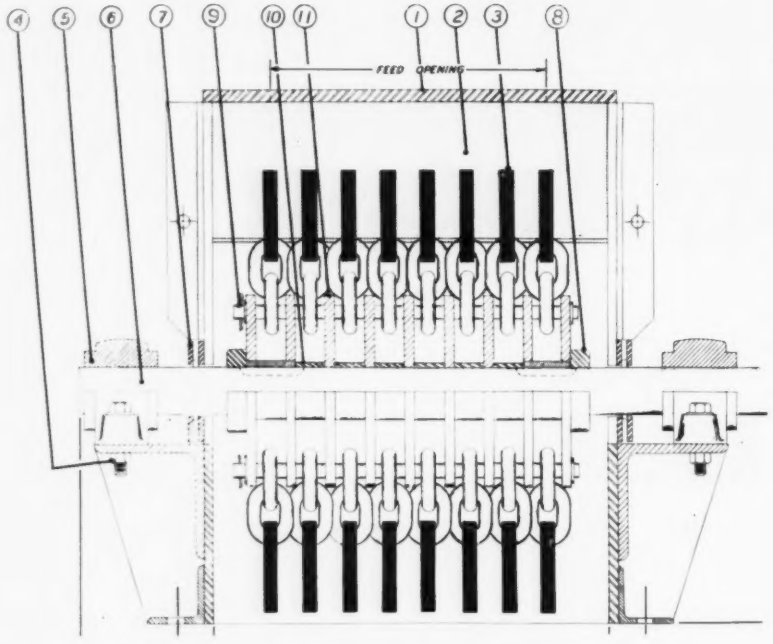
FEECO BUILT CHAIN MILL

1. Unit housing — heavy steel plate
2. Baffle plate
3. Chain hammers — specially hardened
4. Bolts, bearing mounted
5. Bearings — timken tapered roller
6. Shaft, rotor
7. Shaft seal assembly
8. Collar, rotor
9. Pin, hammer assembly
10. Spacers, rotor disc
11. Disc, rotor

Capacity

Model 48-4 30 TPH

Model 30-4 20 TPH



ADVANTAGES OF A FEECO CHAIN MILL

SPECIFICALLY DESIGNED — For breaking oversize granular materials efficiently and at high rates of production.

CRACKING ACTION — No grinding — Full stream of oversize is directed into rotating chains without pulverizing action.

NON-CLOGGING DESIGN — Ample clearance throughout helps flow of material . . . . . prevents build-up and production down time.

EASY ACCESS — Quarter section of housing can be removed by taking out only eight bolts which provides good accessibility.

SIMPLIFIED MAINTENANCE — All component parts can be easily removed and replaced.

DURABLE CONSTRUCTION — Heavy steel housing, oversized bearings and specially hardened chain hammers provide dependability.

FEECO EQUIPMENT — Conveyors — Elevators — Rotary Dryers & Coolers — Preblenders — Ammoniators — Granulators — Chain Mills

COMPLETE SYSTEMS — Granulation — Weighing — Bagging — Shipping — Conveying

NEW PLANT CONSTRUCTION — Granulating — Acidulating — Bulk Blending

U. S. REPRESENTATIVES FOR: DUETAG Pan-granulating Systems

FEECO

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"A Complete SERVICE to the Fertilizer Industry"

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WHAT ARE DRI-SOL® BENEFITS IN MIXED-FERTILIZER PRODUCTION?

REDUCED SHIPPING COSTS

BETTER PROCESS CONTROL

LOWER FORMULATION COSTS

LOWER DRYING COSTS

A DRIER PRODUCT

INCREASED PLANT CAPACITY

FASTER CURING—QUICKER SHIPMENT

IMPROVED FERTILIZER QUALITY

More and more fertilizer manufacturers are turning to DRI-SOL ammoniating solutions as a sure, time-tested way to lower production costs and improve mixed-fertilizer quality.

For in addition to the eight cost-saving and quality-building advantages shown above, DRI-SOL can also help manufacturers offset the high water content of low-strength acid. It also helps to produce grades which are difficult or impossible to make with conventional solutions.

What grade of DRI-SOL meets your needs best? From a wide choice of formulations you can select the solution that offers you the greatest number of advantages. Each grade contains less than 0.5% water. Grades range from 24% ammonia and 76% ammonium nitrate, to 50% ammonia and 50% ammonium nitrate, and are generally available in all the Southern and Midwestern States.

Why not get complete information? Technical data to fertilizer manufacturers available upon request. Write: Agricultural Chemicals Department, Commercial Solvents Corporation, 260 Madison Avenue, New York 16, New York. Offices also located in: Atlanta, Shreveport, St. Louis.

COMMERCIAL SOLVENTS CORPORATION CSC

CHANGES

Dively

Walton

St. Regis Bag Division Reorganizes Marketing

The Bag Division of St. Regis Paper Company has recognized its marketing group, it was announced today by Bernard W. Recknagel, vice president and general manager of the division. The reorganization includes two major staff promotions and the appointment of individual product managers for the agricultural, chemical, food and rock products industries —the main commodity groups to which the division supplies multiwall and textile bags and packaging equipment.

John T. Walton has been appointed division sales director. He will have full responsibility for the administration of the division's sales policy as well as the planning, development, and promotional phases of the marketing activities. Mr. Walton, who will report directly to Mr. Recknagel, has been associated with the bag packaging industry for the past 15 years. He has been active in both manufacturing and sales management capacities, and for the past two years has served as manager of marketing services for the division.

Alfred A. Roetzer will succeed Mr. Walton as manager of marketing services. He will direct the planning and promotion of all of the division's products—multiwall paper bags, textile bags, packaging systems and machinery. Mr. Roetzer has been with St. Regis for 14 years in various engineering management capacities, most recently as general manager of packaging services.

Mr. Walton and Mr. Roetzer will operate out of division headquarters in New York City.

Each of the new product managers will be responsible for the development and promotion of packaging products and systems for his particular commodity group.

John H. Dively has been appointed agricultural products packaging manager. Mr. Dively joined St. Regis in 1945 and has held various positions in packaging services management since that date, specializing in the development and marketing of fertilizer, feed and insecticide systems. For the past two years, he has served as assistant general manager of packaging services and has been responsible for the commercialization of the Force-Flow and Streamflow Packaging systems. Mr. Dively will operate out of division headquarters in New York City.

In addition, Arthur P. Simard has been appointed food products packaging manager; Carl W. Olson has been appointed chemical products packaging manager; and John F. Gruber has been appointed rock products packaging manager.

Smith-Douglass Talks Merger With Parke, Davis

Officials of Smith-Douglass Co., Inc., and Parke, Davis & Co. have confirmed reports that they have been discussing the possibility of a merger.

But it is only a "lukewarm possibility," they agreed.

Harry J. Loynd, president of Parke, Davis, said talks have not reached the stage of establishing terms, but if any sort of union is effected it would involve stock and not cash.

Willard R. Ashburn, Smith-Douglass president, said the discussions began 9 or 10 months ago but have "not materialized into anything approaching a merger."

"There are no immediate probabilities," he added.

Parke, Davis is one of several corporations mentioned in recent reports of possible merger with Smith-Douglass.

Others include National Distillers and Chemical, and Spencer Chemical.

Smith-Douglass had net sales of $53,537,000 in its fiscal year ended July 31, 1960.

Valley Feed Merged Into Wolfkill

Wolfkill Feed and Fertilizer Corp., Monroe, Washington, has merged Valley Feed Company into itself.

New Cooperative Formed By 4 in Mid-West

Landmark Farm Bureau Cooperative, Illinois Farm Supply, Indiana Farm Bureau and Central Farmers Fertilizer have joined hands under the banner of Landmark to set up a new N plant (See Map, Indiana) K. N. Probasco, executive vice-president and general manager of Landmark, made the announcement from headquarters at Columbus, Ohio.

Phillips To Open Memphis Office

Phillips Petroleum Company will open a new Memphis sales division office Dec. 1, the company announced.

The office will handle Phillips petroleum product and fertilizer sales in Mississippi, eastern Arkansas and western Tennessee.

Location of the division office will be announced later by Phillips officials.

R. A. Kurland, former all American basketball player and Phillips division manager in Wichita, will manage the Memphis division, the company announced. He has been with Phillips since 1946.

Miller Chemical & Fertilizer Sold To Alco Oil & Chemical

Alco Oil & Chemical Corporation of Philadelphia announces the purchase of the outstanding common stock of the Miller Chemical and Fertilizer Corporation, Baltimore, Maryland; Miller Chemical Corporation, Charles Town, West Virginia; Union Fertilizer Corporation, Baltimore, Maryland; and the Miller Chemical Company of New Jersey, Bridgeton, New Jersey.

The Miller Companies were purchased at their approximate book value.

Frank D. Andruss, president of Alco, stated that "The areas of compatibility between both companies were too obvious to ignore. The fundamental ability of each company to complement the other enhances the growth potential of the combination. The acquisition will enable Alco and the Miller Companies to consolidate their research efforts and their sales and production know-how in order to meet the growing demands of the expanding agricultural and home gardening markets."

It will permit Alco to enter into the agricultural chemical fields, particularly with its product, SOIL-SET, which has patent protection. It is felt that the proposed acquisition has merit in that it will broaden the product lines and distribution resources of both companies."

W. Newton Long, chairman of the board of Miller Chemical and Fertilizer Corporation and the founder of the Miller Companies, stated that plans call for Miller operations to continue approximately as in the

past with present management and Miller personnel retaining their current positions and responsibilities.

It is anticipated that Mr. Long and Mr. Lawrence W. Cameron, president of Miller Chemical & Fertilizer Corporation, both of whom will continue active in Miller affairs, will join the Alco Board of Directors.

The Miller Chemical and Fertilizer Corporation, founded in 1937, today produces, formulates or markets most major fertilizers, insecticides, fungicides, herbicides, and plant growth regulators required for farm or home use.

Hawaii's Pacific Chemical Sold to S. E. Public Service

Southeastern Public Service Company has completed arrangements for the purchase of Pacific Chemical and Fertilizer's facilities in Honolulu, Maui and Kauai, the two companies announced jointly.

Plans call for the operation of the island facilities as a subsidiary corporation under the Pacific Chemical and Fertilizer name or a similar name.

Many of the present employees will be retained.

Pacific Chemical has been operating in the Hawaiian Islands since 1890, furnishing dry and liquid fertilizers, and agricultural and industrial chemicals to plantations and industry.

Monsanto Reveals Expansion Plans

Monsanto Chemical Company's Agricultural Chemical Division has disclosed that it will expand its facilities for formulating materials to customer specifications in order to get a bigger share of the industrial and agricultural ammonium nitrate market. (See "Industry People".)

The new facilities will be located in key market areas to provide users a quick supply of materials prepared to suit their needs. Manager Sprague will work with marketing personnel in helping customers set up and operate fertilizer bulk blending plants. He also will be responsible for Monsanto field units that supply formulations of ammonium nitrate and fuel oil for industrial purposes.

Arizona Fertilizer Merging With S. W. Agrochemicals

Plans for a proposed merger of Arizona Fertilizer & Chemical Co. with Southwestern Agrochemical Corp. were disclosed at Arizona Fertilizer & Chemical's annual meeting in Phoenix, Ariz.

Frank M. Feffer, Sr., president of Arizona Fertilizer, said directors of the two concerns have approved the merger, subject to approval by stockholders of each company. Arizona Fertilizer shareholders will vote on the proposal at a special meeting November 20 in Phoenix. Southwestern Agrochemical Corp., Chandler, Ariz., said no date has been set for a meeting of that company's stockholders.

Southwestern Agrochemical's annual sales have been running at an annual rate of about $5 million. If the merger is approved, Arizona Fertilizer and Chemical's 1961 sales would rise to $11 million or $12 million and earnings would total $700,000 to $800,000, Mr. Feffer said. In 1960, Arizona Fertilizer earned $96,820 or 30 cents a share on 321,932 shares, with sales of $2,916,176.

Tuloma Will Market American Oil's Nitrogen

Tuloma Gas Products Company, Tulsa, Oklahoma, has expanded its nationwide marketing program for LP-Gas and related products to include the line of nitrogen fertilizer materials formerly sold by affiliated American Oil Company.

John E. Swearingen, president of Standard Oil Company (Indiana), which owns both companies, said, "This marketing move complements our reorganization of January 1, 1961, in which American Oil became our nationwide marketer of basic petroleum products." "Previously," he said, "American Oil has handled all our nitrogen product sales."

R. A. Carter, Tuloma's president, announced at Tulsa that C. J. Struble, of Chicago, manager of nitrogen products sales for American Oil Company, has joined Tuloma at Tulsa as vice president, Nitrogen Products and a director.

In Tuloma's expansion, Schrock Brothers Company, marketers of anhydrous ammonia and other fertilizers, and formerly a wholly owned subsidiary of American Oil, has become a subsidiary of Tuloma. Schrock Brothers markets complete liquid and dry fertilizers through its own retail outlets in the Middle West, and manufactures and services devices that apply anhydrous ammonia directly to the soil. Schrock Brothers headquarters will remain at Congerville, Illinois.

Deming Co. Becomes Crane Co. Division

The Deming Company, Salem, Ohio, has become a division of the 100-year-old Crane Co., and has become a part of Crane's engineered products group. Deming has plants in Salem, Rogers, Ark., Monterrey, Mexico. Walter F. Deming, former Deming president, is general manager of the division.

Progress Changes Name, Offers Common Stock

Progress Industries, Arthur, Illinois, has changed its name from Progress Manufacturing Company, and has, for the first time, placed its common stock on the market. The Liquid Transportation and Storage division of the concern designs and fabricates tanks for transport and storage of liquid fertilizers and other chemicals. The sale of stock will permit financing of sales contracts, plant improvements and a new product which is in the developing stage.

Bemis Divides Central Area

The Bemis Bro. Bag Company has announced division of its geographical central operations area into central and northern operations areas with T. H. Ashton as director of northern operations and S. M. Spencer as director of central operations.

Ashton

Spencer

Judson Bemis, president, said it will provide a smooth transition within the erstwhile central region in anticipation of the retirement next spring of Mr. Ashton, who has directed this key area since January, 1956.

Mr. Ashton, as northern operations director, will retain responsibility for the Bemis Indianapolis, Minneapolis, and Peoria plants, and the Chicago, Indianapolis, and Minneapolis sales divisions, and Minneapolis general sales division. Mr. Spencer, in the revised central region, will direct the company's Kansas City, Omaha, St. Louis, and Wichita plants and sales divisions.

Mr. Ashton has been with Bemis since 1919;Mr. Spencer joined Bemis in 1937.

PEOPLE in the

IMC

Two new district sales managers and two technical sales representatives have been appointed by the materials department, Agricultural Chemicals Division of International Minerals & Chemical Corporation.

New district sales managers are

Ekedahl

Margo

Erick C. Ekedahl, Columbus, Ohio, whose district includes Ohio and Michigan and Donald R. Margo, who will direct sales in Arkansas, Louisiana, Mississippi and Western Tennessee.

Mr. Ekedahl was employed by Rockwood & Co. and Clemson Bros. Inc. before joining IMC.

Mr. Margo, a sales representative for IMC since March 1960, will headquarter in Jackson, Miss.

Sheehy

Zoellner

The newly appointed technical service representatives are Thomas M. Sheehy, Shreveport, La., and James H. Zoellner, Atlanta, Ga.

Mr. Sheehy's district includes Arkansas, Louisiana, Mississippi, Missouri, Tennessee, Arizona, New Mexico, Oklahoma and Texas. He has been employed by IMC as a commercial development engineer since 1957.

Mr. Zoellner is technical service representative in Georgia, North Carolina, South Carolina, Tennessee, Alabama and Florida. He was a senior development engineer of IMC's technical division before accepting the new appointment, and has been with IMC since 1953.

Mid-South

William A. Giffen of Clarksdale, Miss., has been named sales representative of the North Mississippi and Alabama district for Mid-South Chemical Corporation, it has been announced by D. H. Bradford Jr., vice president.

Best Fertilizers

Lowell W. Berry, president and board chairman of The Best Fertilizers Co. of Lathrop, California, has announced his resignation as Best's president. He will continue as chairman of the board.

Mr. Berry also announced that John M. 'Red' Harris of Baltimore, Maryland, has been elected president of Best Fertilizers, and R. Henry Wheless, also of Baltimore, vice president in charge of fertilizer production. Mr. Harris will assume his new duties on November 1, and Mr. Wheless will join Best on December 1.

Since 1956, Mr. Harris has been assistant general manager, Davison Chemical Division of W. R. Grace & Co. in Baltimore. He joined Davison Chemical in 1946 and was successively personnel manager, superintendent of operations at Bartow, Florida, and assistant manager of the phosphate division at Bartow, before being named assistant general manager.

Mr. Wheless has been staff assistant to the general manager, Davison Chemical Division of W. R. Grace & Co. in Baltimore since 1957.

Best Fertilizers of Texas

The Best Fertilizers Company of Texas, Houston, has recently employed E. K. Chandler, former district agronomist for National Plant Food Institute, to work with Best dealers as part of the expanding services offered by the company. The announcement was made last month by Russell C. Dellinger, president of the company.

Chandler

Mr. Chandler had earlier been an assistant professor of agronomy research at Louisiana State University's North Louisiana Hill Farm Experiment Station, and later was fertilizer sales and agronomic educational district representative for Phillips Chemical Co.

Atlas Chemical

The appointment of Dr. Sidney W. Hess as manager of operations research in Atlas Chemical Industries' development appraisal department has been announced. Dr. Hess is a native of Kansas City.

Fibercast

Phillip J. Liston has been named sales manager of the Fibercast Company, division of The Youngstown Sheet and Tube Company. The appointment, effective August 25, 1961, was announced September 20 by Craig Smyser, vice president of Continental-Emsco and general manager of Fibercast.

Fibercast is the world's leading producer of glass reinforced thermosetting plastics, and it is under the direction of Continental-Emsco, also a Youngstown division.

Mr. Liston has been assistant general sales manager in charge of special projects. He has been with Continental-Emsco and Fibercast for the past six years, joining Continental-Emsco in export sales. He had been successively, special projects representative, district sales manager of Fibercast and assistant sales manager.

Freeport Sulphur

Richard C. Wells and Thomas R. Vaughan have been elected members of the board of directors of Freeport Sulphur Company, Langbourne M. Williams, chairman, has announced.

Mr. Wells is executive vice president of the company and chairman of National Potash Company, which Freeport owns jointly with Consolidation Coal Company. He joined Freeport in 1939.

Mr. Vaughan is vice president and general counsel. Following service with the Federal Government in Washington, D. C. and Little Rock, Ark., he joined the company's legal department in 1942.

Peter Black and Arthur W. Gilbart have been elected vice presidents, and Wilmer H. Kingsford an assistant vice president of Freeport Sulphur.

Mr. Black has been president of Sulphur Export Corporation since 1958 when it was organized by Freeport and other U. S. sulphur producers to handle overseas sales. He joined Freeport in 1953 as assistant to the president and was named manager of export sales in 1955.

Mr. Gilbart was employed by Freeport as assistant to the president in 1957 and was named assistant to the chairman of the board in 1958.

Mr. Kingsford was named assistant to the chairman of the board in January of this year; he joined the company in 1957 as a financial analyst.

INDUSTRY

TVA

Last month announced the appointment of Victor J. Kilmer as assistant to the manager of TVA's Office of Agricultural and Chemical Development at Muscle Shoals, Alabama. Among his new duties will be the coordination of special agricultural and chemical projects, both within TVA and with other agencies and groups.

Kilmer

Mr. Kilmer came to TVA from the Agricultural Research Service, U. S. Department of Agriculture, where he was assistant director of the United States Soils Laboratory at Beltsville, Maryland. He was with the Department 17 years.

Central Farmer

Central Farmers Fertilizer Company, regional co-op with headquarters in Chicago and its big phosphate plant at Georgetown, Idaho, has a new top team.

The board and shareholders, in their annual meeting in Chicago elected E. V. Stevenson chairman and Norval Ellefson, vice-chairman. These men succeed D. A. Williams and E. O. Johnson, respectively.

Mr. Stevenson, the new chairman, is assistant general manager of the Illinois Farm Supply Company at Bloomington. Mr. Ellefson is a farmer at Dallas, Wis., and a member of the board of Farmers Union Central Exchange at St. Paul, Minn.

DuPont

Wallace E. Gordon, assistant general manager of Du Pont's Industrial and Biochemicals Department, was appointed general manager October 16, succeeding Clark W. Davis, who will retire at the end of the month after a career of more than 44 years with Du Pont.

At the same time Benjamin F. Schlimme, planning manager of the department, was named assistant general manager to succeed Mr. Gordon.

The Industrial and Biochemicals Department produces the company's agricultural chemicals, anti-freezes, and a broad line of industrial chemicals.

Southwest Potash

W. Aubrey Smith, vice president of Southwest division of American Metal Climax, Inc., announces the appointment of J. S. (Stan) Mitchell as general manager of the nitrate of potash plant now under construction in Vicksburg, Miss.

Mitchell has been transferred from the company's Carlsbad, N. M. operation where he was plant superintendent.

Other staff appointments announced by Mr. Smith include J. Marshall Downey as general superintendent, C. M. (Jack) Gartman, Jr. as maintenance superintendent and Melvin B. Markel as chief accountant.

Monsanto

A. Milton Sprague, manager of Monsanto Chemical Co.'s agricultural division plant, El Dorado, has been named to administer an expanded program in the company's agricultural market.

He will be manager of custom-formulation facilities and will work with marketing personnel in assisting customers to set up and operate fertilizer bulk blending plants.

In addition, Mr. Sprague will be responsible for Monsanto-owned field units that supply formulations of ammonium nitrate and fuel oil for industrial purposes.

Succeeding as manager of the El Dorado plant will be Thomas S. Hostetter, currently assistant plant manager of the agricultural division. Mr. Hostetter joined Monsanto in 1946.

Mr. Sprague, a native of Swans Island, Me., joined the Lion Oil Co. in 1942 prior to its merger with Monsanto. He was employed as assistant manager of El Dorado plant and became manager in 1949.

R. A. Kurland, with Phillips Petroleum since 1946, has been made manager of the new division office in Memphis (See Changes). He has been Wichita division manager.

Ortho

H. J. Grady, president of Ortho division, California Chemical Company, has announced transfer of responsibility for the Richmond Chemical Control Laboratories from Research and Development to the Manufacturing department.

Following the changeover, these appointments for the Richmond Plant were announced:

M. A. LeBrun, Jr., to chief plant chemist.

L. V. Westerlund to lead control chemist.

R. G. Terranova to assistant chemist.

Mr. LeBrun has been with Ortho for 10 years; Mr. Westerlund for 15 years; Mr. R. J. Terranova, for three years.

Bemis Bag

Lyman H. Goff, Jr., manager of the Norfolk, Va., bag plant and sales division of Bemis Bro. Bag Company, has been assigned to the company's Allied Operations staff and will direct paper specialty and polyethylene bag activities, the company announced.

Goff

Boher

Lahey

In related new assignments, R. W. Lahey, Jr., succeeded Mr. Goff as manager of the Norfolk plant and sales division, and R. J. Boher became sales manager of the Norfolk sales division. Mr. Lahey previously was sales manager and Mr. Boher a salesman with the sales division there. Mr. Goff is headquartered in Minneapolis in his new assignment.

Cyanamid

The appointment of Dr. John A. King to the position of manager of research and development of American Cyanamid Company's agricultural division was announced by C. D. Siverd, Division general manager. He replaces Dr. J. T. Thurston who will not be moving to the division's new Agricultural Center near Princeton, New Jersey.

Prior to joining Cyanamid in October of 1960, Dr. King was director of research and general manager for the Research Division of Armour and Company.

Effective immediately, the following department heads located at the Center will report to Dr. King: Dr. J. P. English, director of chemical research; Dr. F. L. Stark, director of plant science research; Dr. J. S.

—Industry People...

Kiser, director of animal science research; Dr. J. F. Yost, director of plant industry development; Dr. S. Brackett, director of animal industry development; Dr. J. H. Ware, director of product research laboratory; F. R. Barron, government registration manager; and Rhoda Alverson, technical service information manager.

Under Dr. King's direction the newly co-ordinated research efforts at the Agricultural Center will be directed toward the development of new and improved products for animal and plant production and protection. Dr. King will report directly to the division's general manager, Mr. Siverd, whose offices are now in the administration building at the Center.

Highway Equipment

Appointment of Gale E. Allen as executive vice president of Highway Equipment Company, and S. L. Myers as vice president was announced by C. H. Jordan, president. Mr. Allen will be administratively responsible for the entire operation of the company and will continue to carry on many of the affairs of general sales manager. In 1958, Mr. Allen joined Highway Equipment Company as general sales manager.

Hooker

Julio J. Usera has joined the recently formed International division of Hooker Chemical Corporation, located at corporate headquarters, 666 Fifth Avenue, New York. His title, director of sales, designates responsibility for managing sales of the division, according to an announcement today by William D. Morrison, general manager of the International Division.

Mr. Usera has been in a similar field with Monsanto Chemical Company for the past 15 years. Since 1959 he had been director of sales of their Overseas division.

Dow Chemical

Dr. Julius E. Johnson, director of Agricultural Chemicals Research for The Dow Chemical Company, has been named manager of the company's Agricultural Chemicals Department.

Herbert D. Doan, executive vice-president of Dow, said Dr. Johnson's new responsibilities will include overall direction of research, development, and product planning activities related to Dow Chemical's interests in the agricultural field. Dr. Johnson joined Dow in 1943.

Texas Gulf Sulphur

H. Newton Cunningham has been named assistant sales manager of Texas Gulf Sulphur Company, according to an announcement by A. Nelson Myers, vice president and manager of sales.

Cunningham

Mr. Cunningham, a native of Texas, will continue to have his office in Houston. For the past year, he has served Texas Gulf as assistant manager of technical sales service and theretofore as assistant manager of the company's Houston traffic department.

Before joining Texas Gulf, Mr. Cunningham served four years in the sales department of the Shippers' Car Line Division of A.C.F. Industries.

Hahn, Inc.

Gilbert E. Betulius has been named general manager of the Sprayer division of Hahn, Inc., Evansville, Ind. The announcement was made by Lloyd Hahn, president.

Mr. Betulius, sales manager since 1950 and a member of the Hahn board of directors since 1956, is recognized authority on farm chemical applications.

Kenneth Bradfield, formerly technical service manager and assistant sales manager, was named marketing manager.

In other administrative shifts, Louis Carroll was named sales promotion manager; Norm Pfieffer, sales engineer; Walter Schnautz, manager of product engineering; James Obermeyer, design engineer, and Jim Niemeier, technical service manager.

The Sprayer division manufactures the Hahn Hi-Boy high speed, high clearance farm sprayer and tractor-mounted and trailer sprayers.

Simonsen Manufacturing

A recent announcement from Merle Simonsen, general manager of the Simonsen Manufacturing Company, Quimby, Iowa reported the appointment of Ray Tongate as sales manager of the company. The Simonsen organization makes a complete line of truck bodies for bulk feed delivery and bulk fertilizer spreading, plus the new compact pull-type fertilizer spreaders.

Texaco can help you stop loss of fertilizer raw materials

Many people in management believe that nitrogen loss in ammoniation, over-analysis, bag breakage, loading and unloading, amounts to only 4 or 5%.

Actually, only the best-run plants have such low losses. More typically, they may approach 15%.

These are findings by Texaco technical experts who help tighten procedures in fertilizer plants as part of the over-all Texaco "Stop Loss" program. For instance, nitrogen losses – including losses of ammonia, N_2 and oxides of nitrogen – are found to be a prime problem in making mixed fertilizer. Our people can advise on proper methods of mixing to avoid losses during ammoniation . . . on plant processes such as crushing, screening, drying, cooling. You can also tap our experts' knowledge of transportation and unloading equipment, storage and handling.

Would you like to have a Texaco man visit you for a look at your possible losses? The service is free. Write to Texaco Inc., *Petrochemical Sales Division,* 135 East 42nd Street, New York 17, N. Y., or 332 South Michigan Avenue, Chicago, Illinois. Dept. CF-42

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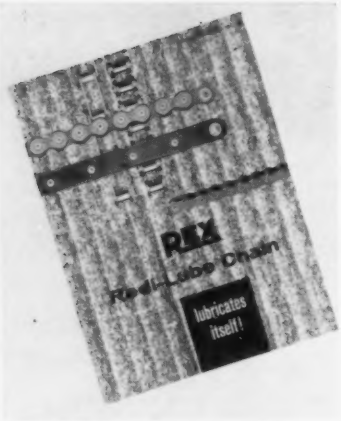


Self-Lubricating Chain

Production of new Rex Redi-Lube Roller Chain — a self-lubricating chain— has been announced by the roller chain division of Chain Belt Company. A new bulletin, no. 6117, covering the product is also available.

The new chain was designed especially for drives and conveyors that can't be lubricated regularly. It provides protection against tough service conditions such as dust, dirt or moisture and is ideal for open and exposed drives. It can be used wherever the strength, wear life, and quiet precision operation of roller chain is needed.

Rex. Redi-Lube's self-lubricating feature is achieved by a heavy, oil-impregnated, sintered steel bushing that replaces the conventional roller and bushing of standard roller chain. The sintered bushing allows 'self-feed' lubrication between bushings, pin and sprocket teeth, assuring constant protection against corrosion, abrasion and friction. Redi-Lube chain also prevents tight joints; provides self-cleaning action; and is interchangeable with A.S.A. roller chain.

For further information about Rex Redi-Lube Crain, circle number 1 on CF's Information Service card, page 67.

Corrosion-Resistant dp Transmitters

Several new options in corrosion-resistant materials for construction of the process-wetted parts of Series 10B1460 dp Transmitters have been announced by Fischer & Porter Company.

The new option include Hastelloy C, Monel, Tantalum, and Teflon. Various combinations of these materials are available in all models of dp Transmitters. These instruments have ranges, in inches of water, of 0-20 to 0-200, 0-30 to 0-300 and 0-100 to 0-1000.

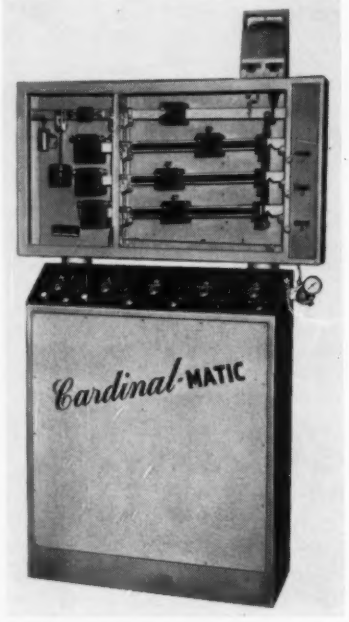
Combinations of carbon steel and 316 stainless steel were available in Fischer & Porter dp Transmitters before the addition of the new options. These materials are still available in both the standard and 'low Flow' types.

Additional information about corrosion-resistant materials for construction of dp Transmitters is available by circling number 2 on CF's Information Service card, page 67.

Electro-Mechanical System

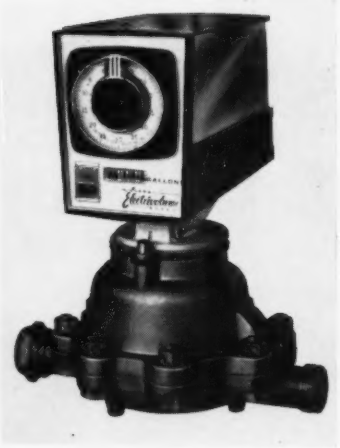
Cardinal Scale Manufacturing Company has announced a new simplified electro-mechanical control system to be used for the weighing, blending, or batching of two or more ingredients. This is connected to conventional mechanical scale levers.

This new economical simplified electro-mechanical system greatly reduces maintenance problems. In almost all cases, in any kind of a



break-down of the system an ordinary electrician can make the repairs. It is customized for the individual user to fit into the manufacturing process for which it is needed. The system, of course, is completely automatic and has automatic cut-off controls. In most cases, delivery of this new simplified system can be made for any installation within a period of ten days.

For more information concerning the new Cardinal-Matic, circle number 3 on CF's Information Service card, page 67.



'Electrivolume' Meters

With the announcement of full scale production of the Niagara Electrivolume Meter, Buffalo Meter Company brings new concept of automation to the entire liquid processing industry. This new meter delivers a pre-set quantity of liquid at the press of a button. On completion of the delivery cycle, the meter mechanism is automatically re-set to duplicate the delivery when the button is again depressed.

One Electrivolume Meter can be used to actuate other Electrivolume Meters to automatically deliver pre-set quantities of other liquids in any desired sequence. It is only necessary to press the button at the master meter to put the entire series of meters into operation.

The Niagara Electrivolume Meter can be used to start or stop pumps, to operate solenoid valves, signaling devices, electric relays and other processing equipment to make the meter the master control center for a complete cycle of operations.

Electrivolume Meters are available in a variety of sizes and capacities to handle almost every liquid including a wide variety of corrosives.

For further information, circle number 4 on CF's Information Serv ice card, page 67.

High Speed Shear Mixers

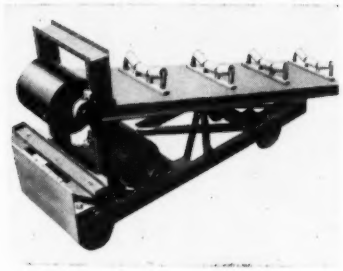
Convertible open/closed turbine mixers developed by Barrington Industries incorporate an adjustable rotor-stator clearance to regulate the shear and dispersing action.

Decreasing the distance between rotor and stator increases the homogenizing and dispersing action of the mixer.

Increasing the distance between rotor and stator increases the pumping, blending and mixing action, and increases the capacity of the mixer.

These adjustments can be made on the corrosion resistant stainless steel rotor assembly by simply turning the motor shaft adjusting nut. The unique feature is exclusive to Barrington mixers and is covered by a pending patent application.

For additional information, circle number 5 on CF's Information Service card, page 67.



New Belt Tripper

A new, heavy-duty cable-propelled belt tripper, which permits discharge of material to points along the length of a conveyor system, has been added to the line of materials handling equipment manufactured by Finco, Inc.

The belt tripper is a 5500 lb. unit with a 36" wide belt, built expressly for high-capacity stockpiling operation. It is 18-ft. long, 4½-ft. wide and 7-ft. high. It is track-mounted.

The Finco cable-propelled tripper is for installations where a power-propelled tripper is required, but where electrical conductors or trolley wires are undesirable.

Movement of the tripper, forward or reverse, is accomplished by a single wire rope suitably reeved through the tripper and a stationary sheave, and driven by a winding machine. Travel speed is approximately 30-ft./min.

For additional information, circle number 6 on CF's Information Service card, page 67.

Versatile Crusher-Shredder

Bauer's No. 7-AB Crusher-Shredder, a heavy duty unit with a wide range of crushing, pre-crushing or shredding applications in operations where a minimum of fines is desired, is described in Bulletin G-6, now available from The Bauer Bros Co.

A photo-diagram points out design and construction features of the unit which can be used for crushing lumpy chemicals, copra, clay, coke, shells, cobs and similar materials.

The crusher-shredder is available in two sizes —with an 18" or 35" wide inlet opening.

For a copy of Bulletin G-6, circle number 7 on CF's Information Service card, page 67.

The Story of Fibercast

A colorful new booklet, 'The Story of Fibercast,' is being offered by the Fibercast Company, a division of the Youngstown Sheet and Tube Company.

The 12-page, 4-color booklet deals briefly with the advantages of Fibercast pipe and describes its uses in a broad range of industries. Fibercast is compared with other non-metallic pipes, and the nature of construction is described as it relates to axial strengths, flow factors, collapse strengths, impact and torque strengths, joint strengths, heat conductivity, electrical resistance, linear expansion, and abrasion resistance.

Fibercast pipe has found a wide range of applications in the fertilizer industry, particularly in handling phosphoric acid.

For your free copy of 'The Story of Fibercast', circle number 8 on CF's Information Service card, page 67.

Unified Process Control

A new bulletin (239.12A) on the Rockwell-Republic unified process control center is available from Republic Flow Meters Company, Subsidiary of Rockwell Manufacturing Company.

The four-page publication describes the company's compact equipment for combining readout and control functions with a four-inch strip-chart recorder in a single panel assembly. Bulletin is profusely illustrated and a diagram providing installation data for the control center is also included.

Copies of the new publication may be obtained by circling number 9 on CF's Information Service card, page 67.

Dust-Tight Chain Drag

A newly designed self-contained, dust-tight double roller chain drag with steel scrapers that will handle 9000 cu. ft. per hour is announced by Sprout, Waldron & Company, Inc. For top carry only the unit can be made in lengths up to 230 feet and for both top and bottom carry, up to 172 feet. Handles materials gently and is self-cleaning.

For additional details, circle number 10 on CF's Information Service card, page 67.

Portable Sprayer

The Broyhill Company has announced development of a special high and low pressure portable sprayer, which can be used for either hand or vehicular application.

Golf courses and cities have found it especially useful for application of chemicals to care for greens, fairways, and other turf areas. The high pressure system can be utilized for spraying trees and shrubbery.

The unit can be easily attached to any standard 3-point hitch. Mechanical agitation assures complete mixing of either wettable powders or emulsifiable liquids.

For detailed information, circle number 11 on CF's Information Service card, page 67.

Pneumatic Handling System

A four-page technical report describes how a pneumatic conveying system eliminates an air pollution problem at a Stauffer Chemical Company plant in San Francisco. Available from Fuller Co., the new report details the changeover from an open-type conveyor to an enclosed pneumatic system in the handling of borax ore.

The report describes how a Fuller Airveyor® system provides automatic delivery of material from rail car through a cyclone separator-filter to a 20,000-ton capacity storage area. The system is designed to permit alternate delivery to a reclaiming weigh-hopper, either from rail car or storage.

Two photographs show the filter-separator and the 5" pneumatic conveying line in use at the rail car unloading station.

For a copy of Fuller Fact File ER-28-1, 'Dust-Tight Handling System Averts Community-Relations Threat', circle number 12 on CF's Information Service card, page 67.

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New Boom Sprayer

A new field and row crop boom sprayer being introduced by Sprayfoil Corporation, features 39 sprayheads of the patented new airfoil design. The company reports that airfoil spraying achieves better coverage and penetration than conventional nozzle spraying can, and does so with radical savings in man hours and material.

Airfoil spraying uses a low pressure-high velocity airstream to move the spray material over aerodynamic foils and onto the crop being sprayed, enveloping the object being sprayed like a cloud of fog.

The new Sprayfoil field and row crop sprayer is available in standard widths of either 33 or 40 feet with booms extended. Both models have adjustable wheel spacing on the trailer which supports the unit. Wheels may be spaced anywhere from 48 to 96 inches apart to conform to planting pattern of any crop.

The airfoil sprayheads are easily detachable to permit varying patterns of spray for different crops.

The chemical tank is of fiberglass construction, holding 200 gallons. Normal chemical consumption of the Sprayfoil field and row crop sprayer is 2 to 25 gallons per acre, depending on tractor speed.

A centrifugal pump moves the spray material from tank to sprayheads, where the airstream takes over. The blower assembly develops air velocity from 150 to 200 mph at vey low air pressure. Air pressure seldom exceeds one pound per square inch at the sprayheads.

Booms are made of fiberglass. They are adjustable for ground clearance from 20 inches to 66 inches.

The sprayer may be ordered either with its own engine or with connection to operate tractor power.

For more information, circle number 13 on CF's Information Service card, page 67.

Liquid Fertilizer Pumps

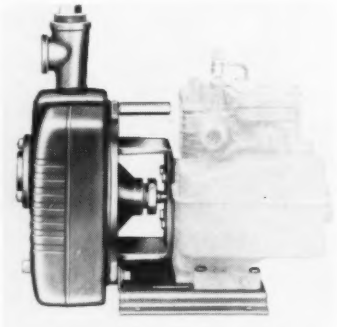
A 20-model line of 1½" self-priming centrifugal pumps designed for transfer of liquid fertilizers, petroleum and water has been introduced by Barnes Manufacturing Co.

The new pumps will meet the liquid fertilizer requirements of bulk stations, storage tanks, truck transports, nurse tanks and field applications.

All models are available in either aluminum or cast iron and pump up to 7000 GPH with heads to 120 ft. The new pumps are not close-coupled and bolt onto any standard engine. Electric and universal-drive models also are available.

According to Barnes, you simply slide the pump onto the crankshaft, tighten four bolts, a pump shaft locking collar and the pump is ready for operation.

The new line is designed and built to withstand the severe corrosive action of liquid fertilizers. All pump components are made from special acid and abrasive-resistant materials for minimum pump maintenance. Shaft locking collar does double duty as a slinger to prevent liquids



from reaching the engine. Pump body, impeller, volute and mounting head are cast iron (except aluminum models), with solid stainless steel pump shaft, Buna-N check valve and ceramic shaft seal.

Of special interest to fertilizer pum pusers is the large tapered area around the shaft seal in the new Barnes pumps. This V-shaped area provides an unusually large amount of cooling and lubricating space, reportedly increashing seal life.

Free detailed literature, showing specifications and performance characteristics of the new line, said to prime in well under 60 seconds, may be obtained by circling number 14 on CF's Information Service card, page 67.

Pump Shaft Seal

Dry face sealing in the chemical processing industry is now possible with a new type of seal, according to Donley Products, Inc.

Named the Circo-Flex Seal, their new dry face mechanical shaft seal running in the pumpage requires no stuffing box gland water, lubrication or cooling and will accept stuffing box pressures to 100 psi, product temperatures to 600° F. and shaft speeds to 3600 R.P.M. In addition, the seal has proven excellent in vacuum service and will handle slurrys to micron dimensions.

The new Circo-Flex seal operates inside the stuffing box and once installed requires no maintenance or adjustments. The pumpage is not in contact with the shaft. There is no product contamination from gland water and lubricating devices.

The seal is made in a number of special materials for use in corrosive service including carbon, #316 stainless steel, inconel, titanium and tantalum. The seal is now available through pump manufacturers.

Literature describing the many features of the Circo-Flex Seal is available by circling number 15 on CF's Information Service card, page 67.

Material Level Control

A heavy duty relay with 10 amp. rating is a new optional feature of the Flo-Level L-400 series rotary paddle material level controls.

Made by Flo-Tronics, Inc., Electronics Control Division, the transistorized L-400 is available in either weather-and-dust tight or explosion-proof enclosures.

This compact control unit is easily mounted on bin, hopper or tank walls at the desired control points by use of a 1¼" pipe coupling. The flexible sealed shaft extends into the interior; sensing paddle rotates continuously when not surrounded by material. A 11 inch-ounces of torque will stop the paddle.

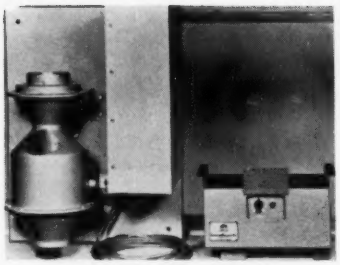
On the high level model paddle stoppage causes desired control or signal action. Paddle release effects control or signal action on the low level model.

Control signal is generated by a novel circular magnet mounted on the motor shaft. An auxiliary winding on the shaded-pole induction motor provides power for the transistor amplifier circuit.

All models have a unique fail-safe circuit which automatically prevents unsafe operation in the event of power failure or a component malfunction.

Ratings for standard relays on L-400 are: 5 amperes at 110 volts, 60 cycles; or 3 amperes at 220 volts, 60 cycles. Ratings for optional heavy duty relays on L-400 are: 10 amperes at 110 volts, 60 cycles; or 5 amperes at 220 volts, 6 cycles.

For additional information, circle number 16 on CF's Information Service card, page 67.



Dry-Flow Meter

A new space-saving and motorless version of a device for measuring, by weight, the flow of almost any dry material has been announced by Industrial Powertronix, Inc., successors to Industrial Processes, Inc. With dimensions of only 22-inches in height, 18-inch width and 11-inch depth, the smallest model "IPI" Dry-Flow Meter accurately measures flows as small as 5 lbs. per minute. Seven models for 2" to 14" spout sizes, in 2-inch increments, are currently available in the Model 'A' series. The largest unit has overall dimensions of 36-inches in height, 33-inch width, and 24-inch depth, and is capable of measuring up to 3500 lbs. per minute.

According to the manufacturer, the units have only one moving part, which is an air bearing with no metal-to-metal contact. This feature is said to reduce maintenance to a minimum and eliminate bearing failure due to dusty or corrosive atmosphere. Readout from the meter is accomplished by changing the flow pressure to electrical current through a transistorized electronic unit incorporating a piezomagnetic transducer.

Materials successfully measured with an accuracy of plus or minus 1% include flowing materials, such as carbon black, pelletized products and wood chips.

For additional information and prices, circle number 17 on CF's Information Service card, page 67.

Glasteel Storage Tanks

A new, six-page bulletin discussing the uses and advantages of Glasteel Chemstor Tanks for storing a wide range of products including corrosive materials, purity-sensitive materials, and sticky materials is now available from The Pfaudler Co., a division of Pfaudler Permutit Inc.

The bulletin discusses such new improvements in Chemstor Tank design as increasing the operating temperature range from 125° F. to 180° F. for sizes up to 10,000 gallons. Also discussed is the availability of Chemstor Tanks supplied with agitators and/or heating panels. The agitators and heating panels can be used to blend materials, dissolve solids in liquids, wash one liquid with another, and maintain the environment above ambient temperatures to prevent solidification of certain products.

One section provides physical specifications and design data for various sized Chemstor Tanks.

Copies of this new literature can be obtained by circling number 18 on CF's Information Service card, page 67.

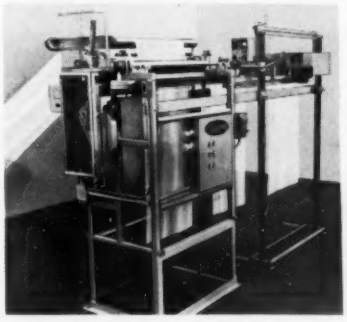
Plastic Bag Fabricator

A bag fabricating system which combines the tested and proven Doughboy continuous band sealer with the Doughboy bag feeding unit has been announced by the Mechanical Division of Doughboy Industries.

Development of the system makes it possible to manufacture a general range of heavy duty polyethylene industrial type bags (or case and drum liners) entirely automatically with the time proven Doughboy positive closure.

The system will produce up to 40 bags a minute (single web) and handles two or more narrow webs for multiple production of smaller bags. Doughboy packaging specialists explain that the system produces bags up to 40 inches wide and 70 inches long and bag lengths are controlled to ⅛ inch or less. It handles film gauges from 2 mil to 10 mil or more.

The bags are made from tubular roll stock and the film is fed vertically as the machine measures and cuts



the length very accurately on a continuous smooth-flowing motion. The final seal is made on a Doughboy band sealer.

All operations are mechanically controlled without solenoids or air valves. Optional equipment includes an electric eye for printed bags and also a bag taping device. With the Doughboy taping device, tape is applied automatically in the sealing process and the unit is available as an optional feature in the band sealer.

Increasing interest in this reinforced closure for industrial type bags designed for heavy loads of 50 or more pounds has been shown, and bags for fertilizer, seed corn and chemicals come in this category.

For full details, circle number 19 on CF's Information Service card, page 67.

Low-Head Screens

How the direct-mounted motor on the Low-Head screen saves headroom, reduces belt cost and wear, and simplifies maintenance is described in new literature released by Allis Chalmers.

Diagrams illustrate how the direct-mounted motors eliminate overhead super-structures for mounting motors, complicated gantry-type motor supports, and belt tensioning and alignment problems associated with conventional screen motor mountings.

Copies of 'The Motor Rides Piggyback,' 26B9996, are available by circling number 20 on CF's Information Service card, page 67.

Vibrating Conveyor

A brochure describing their new natural frequency vibrating conveyors with exclusive variable stroke positive drive is available from Stephens-Adamson Manufacturing Co.

The new conveyors are the first of their type with a variable stroke positive drive that provides infinitely variable conveying speeds from zero to maximum. Conveying speeds are controlled accurately regardless of conveyor length or capacity handled, and can be changed even while the conveyor is in operation.

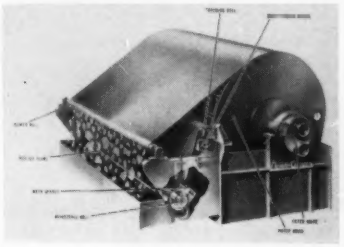
Changes in conveying speed can be helpful for bagging or packaging operations, and in many instances the conveyor can serve as a feeder, reducing the amount of equipment needed.

Copies of Bulletin 361 can be obtained by circling number 21 on CF's Information Service card, page 67.

New Filter Belt Design

A new belt filter design, which finally solves the related problems of smooth application of the medium to the filter drum and uniform and controlled belt tracking, has been introduced in a full range of sizes and materials by Dorr-Oliver Incorporated.

The D-O Webtrol Filter applies dependable web tracking control and web spreading equipment to a new version of the basic Oliver vacuum drum filter design. A bowed roll spreads and smooths the fabric, holding the medium flat against the filter drum under uniform tension. A sensitive edge-position device operates through a modern feedback circuit to adjust continuously a

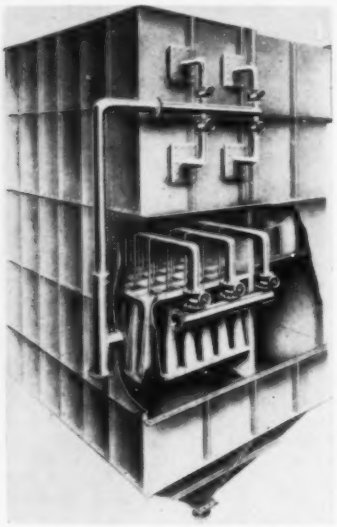


tracking roll located so that it can position the belt directly on the filter drum.

The Webtrol Filter is particularly applicable to slurries which tend to blind the cloth, and to operations where a sufficiently high filtrate clarity cannot be obtained with the usual types of vacuum drum filters. In many cases, the Webtrol Filter can be used effectively where a precoat filter would normally be considered.

The Webtrol Filter is especially applicable to: potash slimes removal, clay de-watering, sewage sludge dewatering, tank-house slimes removal, lime mud filtration, and similar operations.

For additional details, circle number 22 on CF's Information Service card, page 67.



New Venturi Scrubber

Buell Engineering Co. has announced a new venturi scrubber for separating entrained solids from high-temperature gases in fertilizer and other processing operations.

The Buell scrubber, manufactured under an exclusive U.S. license from Waagner-Biro, Austria, offers advantages of low pressure drop and low water requirements. These in turn result in lower power requirements and lower operating costs.

The scrubber is unique, subjecting exhaust gases to a double scrubbing action as they pass through a bank of venturis. At each venturi, a nizzle sprays a cone of water into the belled venturi entry, and the gas receives its first scrubbing as it passes through this wall of spray.

It receives its second scrubbing within the venturi as it passes through a second inverted cone formed as the water rebounds from the belled mouth into the throat of the venturi. This deflection of the water decreases its velocity and breaks it into smaller droplets. While this takes place, the velocities of the gas and entrained solids are increased, due to the narrowing throat of the venturi. Thus, the faster moving gas stream passes through the slower moving water spray and is subjected to the second scrubbing action. The scrubber cleans gases of dust particles as small as 0.05 microns at efficiencies of 99% plus.

Additional information on the new scrubber may be obtained by circling number 23 on CF's Information Service card, page 67.

Filter Fibers Comparison Chart

The Filtration Fabrics Division of American Machine and Metals, Inc., is offering a free chart showing the resistances of all generic fibers to acids, alkalies, salts, solvents and oxidizing agents. The chart indicates the concentration and temperature of the reagent and the extent to which the fiber and/or reagent resist chemical change. The chart also defines the generic, man-made fibers and specifies the various trade names.

The design group of Filtration Fabrics Division developed the chart and is ready to assist in specific problems of textile application and fabrication.

For a copy of the chart, circle number 24 on CF's Information Service card, page 67.

New Filter Mask

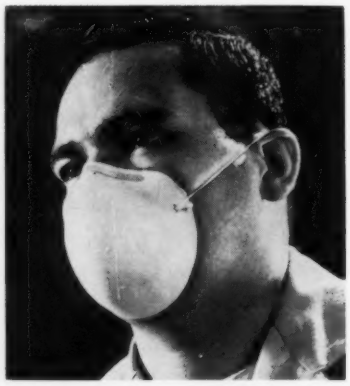
A new featherweight filter mask that combines high filtration and comfort has been made available nationally to the industrial trades by Minnesota Mining and Manufacturing Co.

The mask is designed for maximum filtration of non-toxic dust and sprays.

The new '3M' brand filter masks No. 8200 are made of a non-woven fabric. They are said to provide 3 to 5 times more filter area than other masks because they are all filter and are shaped to stay away from the nose and mouth.

An elastic headband seals the single-unit mask around the edges and a flexible metal nosepiece adjusts to fingertip pressure. The mask conforms to any face and allows easy breathing, unmuffled conversation and unobstructed vision.

The mask's large filter area reduces resistance to inhaling and exhaling and slows breath passing through the filter down to 30-40 feet per minute. This very low speed



eases breathing, making the mask comfortable to wear, and making filtering action more efficient.

Test results showed the '3M' brand filter mask removed 82.9% of dust ranging from 0.1 to 10 microns from inhaled air. Fertilizer dust ranges from ½ to 40 microns.

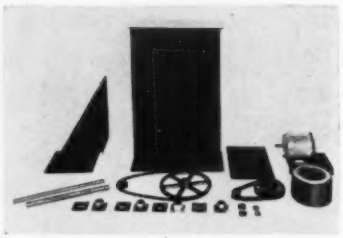
Nine '3M' brand filter masks weigh less than one ounce. The cool, dry masks are reusable, yet inexpensive enough to discard after a single wearing.

Masks are packaged 50 to a box and are available at industrial distributors.

For further information, circle number 25 on CF's Information Service card, page 67.

Valve Sizing

A 4-page technical paper on valve sizing is now available from Jordan Valve, formerly OPW-Jordan, now a division of Richards Industries. 'A Practical Look at Valve Sizing' is an explanation in layman's language that tells exactly what appears in undersized and correctly sized pressure reducing applications. For a free copy, circle number 26 on CF's Information Service card, page 67.



Bucket Elevator Kits

New literature describes important new design of Bucket Elevators shipped from stock in kit form for field assembly.

The 'Buck-El Lift-It-Kits' are centrifugal discharge bucket elevators for elevating bulk materials. All components are pre-engineered, shipped boxed ready for quick on-the-job assembly. Simple and complete instructions accompany shipment.

Brochure specifies complete kit components as well as optional accessories, such as additional midsections for increasing lift of elevator and a bag and drum loading hopper.

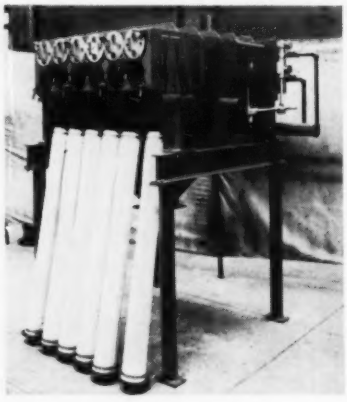
For detailed information, circle number 27 on CF'c Information Service card, page 67.

New Filter-Collector

A major development in Filter-Collector design featuring pre-assembled, individual sock-cage construction has been announced by The Young Machinery Company, Inc. Referred to as 'Uni-Cage', the new design eliminates three major shortcomings of other dust filters: (1) the excessive down-time required to replace worn socks and (2) the difficulties encountered in entering the unit to replace filter bags, and (3) dust leakage around bag frames.

Young Trans-Vair Filter-Collectors operate on high or low pressure impulse air controlled by solenoid valves and actuated either manually or by an electrical timer. The major innovation is the Uni-Cage construction which permits removal of individual cage and sock assemblies and immediate replacement of completely assembled spare units. This reduces downtime to a matter of minutes.

Uni-Cage Filter-Collectors are available in three standard models covering eighteen different capacity ranges with filter area from 6.8



square feet to 368.4 square feet. Custom designs are available for every dry dust filter-collector problem.

Further details are available by circling number 28 on CF's Information Service card, page 67.

Solid-Woven Belting

New, specially-engineered solid-woven belting, now available from Hewitt-Robins, incorporates the strength and bulk of cotton with the resilience and strength of nylon. The solid-woven belt, woven as one heavy, solid unit, is manufactured by the company in three basic grades to provide the best 'job-engineered' belt for specific applications . . . impregnated and covered with polyvinyl chloride for underground mining, with neoprene for both under- and above-ground use, and with various rubber compounds for general industrial use.

Carcass of the new belting is woven on a textile loom as one heavy, solid unit. Heavy-duty, long-staple cotton cords are combined with high-strength, high-elongation nylon cords, completely interwoven in both the warp (lengthwise) and filler (crosswise) direction. In this way maximum design characteristics are obtained from both fibers. The finished carcass is one very-heavy ply, with an extremely coarse weave.

Using a variety of rubber compounds for coating, the company also manufactures a type of solid-woven belt for all industrial applications, with excellent impact and puncture resistance. It is extremely flexible (for 35° and 45° deeptrough idlers), has outstanding high-cover adhesion, and is able to operate over smaller pulleys (high warp crimp).

For further information circle number 29 on CF's Information Service card, page 67.

Miniature Vibrator

A miniature lightweight vibrator, the 7½ ounce BD-13, with great power and ruggedness has been added to the line of 'Vibrolator' Vibration Inducers manufactured by the Martin Engineering Company.

The BD-13, in spite of its miniature size, will handle up to 10 cu. ft. capacity bins. It is used to bring powdered, particulate or crystalline materials out of hoppers, down chutes and through screens.

Silent operation is inherent to the BD-13, which is fitted with a replaceable jet for greater air economy. Maximum air consumption is 6 cu. Ft./min. (free air at 80 PSI), declining as the requirement for high speed operation declines and air pressure is reduced. It will operate on as little as 5 PSI.

A chrome steel ball, driven in an orbit on replaceable raceways of hardened high-alloy steel, produces infinitely controllable frequencies from 0 to 22,000 cycles/min.

The steel ball is the only moving part in the BD-13, which requires no auxiliary equipment such as lubricators or filters. It is safely used in explosive atmospheres. Operation in high ambient temperatures does not harm the unit.

Special lug design permits mounting in any position with a single bolt.

Natural aluminum finish is available for use where paint or enamel may be objectionable. The BD-13 is priced at $16.95.

For complete information, circle number 30 on CF's Information Service card, page 67.

Continuous Chemical Analysis

A new differential AutoAnalyzer® for continuous chemical analysis, with automatic blank or interference compensation, that can detect trace materials down to parts per billion with an accuracy of 1%, is announced by Technicon Controls, Inc.

AutoAnalyzers are available for single or multiple component determinations, for laboratory or plant use. Among the host of materials analyzed by the Technicon system are cyanides, silica, phosphates, iron, chloride, sugars, aluminum, sulfates, copper, etc.

The compact self cleansing system is of modular design, affording ease of maintenance.

For further information, circle number 31 on CF's Information Service Card, page 67.

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Association Activities

Pacific N. W. Convention Will Reveal Active Local Programs

Just ahead, —November 2-3, Hotel Gearhart, Gearhart, Oregon, is the 13th annual convention of the Pacific Northwest Plant Food Association. Back of these 13 years is a story of highly constructive work for the good of farmers and of our industry, which is well exemplified by this quick review of current activity:

Grant Braun, chairman of the association's soils improvement committee has had this to say:

"Our newly announced program of fall fertilization of forages and pastures in western Oregon, which is being sponsored by the fertilizer industry and Oregon State university, may be just the beginning of an important movement to lengthen the fertilizer season.

"Presently in Oregon 75 percent of the fertilizer moved is in the three month period of the second quarter.

"Fall fertilization of forages and pastures is a natural for the farmer in western Oregon, because of the normally open winters and the rainfall distribution.

"Fall fertilization of forages and pastures is also a natural from a fertilizer dealer standpoint.

Art King, soils specialist, Oregon State University, amplifies the facts about this program, as follows:

"The OSU campaign will put special emphasis on fall fertilization of forage though it will include all other crops where fertilizer can be effectively used in the fall.

"The OSU program will include:

"1. A circular letter to county agents.

"2. T. L. Jackson, professor of soils, and the writer will prepare special feature articles which will appear in the Oregon Farmer in September.

"3. Larry Alban and the writer will prepare an attractive three fold circular on the fall use of fertilizer.

"4. During late August and September, meetings will be held with county extension agents and local dealers.

Karl Baur, a member of the soil improvement committee, adds this comment:

"Oregon fertilizer mixers and dealers are preparing an extensive program to stimulate the use of fall fertilization, with special emphasis being placed on legume and legume grass mixtures as recommended by the experiment station and extension service of Oregon State university.

"Area dealers are working with farmers in taking soil samples and will have adequate stock of these special fertilizers on hand. They will also have literature available on the fall fertilization program. Various meetings are also scheduled to more fully explain the program to farmer customers.

Canadian Association Elects Johnson

The 28-member Canadian Fertilizer Association has elected Glen H. Johnson, president for the 1961-62 term. Mr. Johnson is manager of the agriculture chemicals division, Swift Canadian Co.

Soil Programs Launched in Idaho

September 25 and 26 were red letter days in Bingham and Bonneville Counties in Idaho when two new Intensified Soil Fertility programs will be launched.

Kick-off banquets for the soil fertility campaign were to be held, followed by Intensified Soil Fertility Week in both counties, October 5 through 12.

The Idaho Intensified Soil Fertility campaign is being sponsored jointly by the University of Idaho Agricultural Extension Service and the Western office of the National Plant Food Institute.

Due to excellent results obtained from Intensified Soil Fertility programs in three Idaho counties, Fremont, Jefferson and Madison, during the 1960-61 season, it was decided to expand the program in two new counties, explains Dr. R. B. Bahme, Western Director, National Plant Food Institute.

The fertilizer industry in the West will cooperate with local newspapers, radio and television stations in Bingham and Bonneville Counties in supplying articles and advertisements to promote and publicize the campaign.

Indiana Plans December Conference

The annual Indiana Fertilizer Conference is scheduled for December 12 and 13 at Memorial Center, Purdue University, Lafayette, Indiana. A good program is being developed, according to A. S. Carter, Director of Seed Control and State Chemist Services.

Recent Folders Released In California and Minnesota

As a straw which shows how actively the fertilizer industry is promoting itself, the same mail brought to the editorial desks two folders.

The one from California is headed "Career opportunities in the fertilizer industry, a major segment of Agribusiness", and the title explains what it is. Released by the Soil Improvement Committee of CFA, the folder goes into the range of jobs-with-a-future, from crop production to agricultural journalism.

The Minnesota folder, released jointly by the Minnesota AES, the Minnesota Bankers Association and NPFI, show the results obtained by famers who followed the recommendations of the Soils Department of the University of Minnesota. Good management was emphasized as an essential ingredient in farm success.

Paper Sack Association Elects Recknagel

Bernard W. Recknagel, vice president, St. Regis Paper Co., was elected president and F. Gregg Bemis, chairman, Bemis Bro. Bag Co., was elected vice president of the Paper Shipping Sack Manufacturers' Association, Inc., at its 28th Annual Meeting recently held at The Greenbrier, White Sulphur Springs, West Virginia.

Board of Directors elected, were: F. G. Bemis, Bemis Bro. Bag Co.; T. W. Brown, Jr., Owens-Illinois; J. R. Clements, Raymond Bag Corp., Div. of Albemarle Paper Mfg. Co.; H. Holden, Kraft Bag Div. of St. Marys Kraft Corp.; W. J. Jennings, West Virginia Pulp & Paper Co.; E. K. Ludington, Jr., Chase Bag Co.; G. D. Morgan, Jr., Seaboard Bag Corp.; H. M. Recher, Union Bag-Camp Paper Corp.; B. W. Recknagel, St. Regis Paper Co.; A. A. Scholl, International Paper Co., Bagpak Div.

Frank Pocta was re-elected Executive Secretary and Treasurer.

Rocky Mountain and NPFI Co-sponsor Fertilizer Plans

Continuation of the Colorado Soil Fertility Training Sessions in Western Colorado was assured through the joint cooperation of the National Plant Food Institute's Western Research and Education Committee and the Rocky Mountain Plant Food Association during discussions at the fall business meeting of the Association held at Silver Springs Lodge near Durango, Colo., September 8.

M. J. "Bud" Hartman, Phillips Chemical Company and Intermountain section chairman of the Western Research and Education Committee, reported that more than 200 fertilizer representatives participated in the Colorado Soil Fertility Training Sessions series held at four Northwestern Colorado locations during 1961 and recommended that the program be expanded to Western Colorado during 1962.

Under the leadership of Ed McMillan, Spencer Chemical Company and President, Rocky Mountain Plant Food Association, funds have been made available to continue the Agronomy Achievement Scholarship at Colorado State University.

The Rocky Mountain Plant Food Association also will co-sponsor the Colorado Achievement Awards Program for 200 bushel corn growers and 10,000 pound beet sugar producers in cooperation with the National Plant Food Institute.

Ideas and suggestions for the Colorado Fertilizer Conference to be held in January, 1962, at Colorado State University were discussed and a proposed program developed featuring range and meadow fertilization, fertilizer effects on crop quality, irrigation-fertilizer relationships and results of Intermountain Intensified Soil Fertility programs.

MEETING BRIEFS

Nov. 6: South Carolina Annual Plant Food Conference, Clemson House, Clemson.
Nov. 13-14: Oklahoma Annual Plant Food Conference, Tulsa Hotel.
Nov. 13-14: Florida Soil Science Meeting, Tallahassee.
Dec. 4: Minnesota Soils and Fertilizer Short Course, Koffee Hall, University, St. Paul.
Dec. 6 7: Alabama Winter Plant Food Conference, Whitley Hotel, Montgomery.
Dec. 7-8: Michigan Fertilizer Conference, Kellogg Center, E. Lansing.
Dec. 7-8: Missouri Fertilizer Conference, Student Center, Columbia.
Dec. 11: Washington Liquid Fertilizer Dealers Association Annual Meeting, Hotel Davenport, Spokane.
Dec. 12-13: Indiana Fertilizer Conference, Memorial Center, Lafayette.
Dec. 13-14: Louisiana Annual Plant Food Conference, Capitol House, Baton Rouge.
Dec. 14-15: Ohio Fertilizer Conference, Student Union, Columbus.
Dec. 18 19: Kansas Fertilizer Conference, Umberger Hall, Manhattan.
Dec. 19: North Dakota Fertilizer Conference, Student Union, Fargo.

Groups attending the annual fall meeting of the Rocky Mountain Plant Food Association in September at Silver Streams Lodge, Bayfield, Colo., were:
1. Officers and Board of Directors—Back row, left to right: Ed McMillan, Spencer Chemical Co., Colorado Springs, president; Elwin McVickar, Wylie Elevator Co., Wylie, Colo.; Bill Griffith, Phillips Petroleum Co., Denver, secretary; and Bob Pitcher, Colorado Plant Food Co., Rocky Ford. Front row, left to right: R. E. 'Monty' Monteith, Simplot Soilbuilders, Greeley; and Jerry Brim, Wilson & Geo. Meyer & Co., Denver. Directors missing are Frank Hall, Morgan Elevators, Morgan, Colo.; Ralph Dush, Farm Chemicals Co., Longmont; and Walter Craig, C. D. Smith Co., Grand Junction.
2. Potash Representatives—Left to right: Frank Kennedy, Potash Company of America, New York City, and Bob Billings, Potash Company of America, Ames, Iowa.
3. Phosphate Fertilizer Producers—Back row, left to right: Keith Campbell, Western Phosphates, Inc., Salt Lake City; Pete Schultz, Caprock Fertilizer Co., Littlefield, Texas; Bert Hoffman, J. R. Simplot Co., Boulder; Bernard Brown, J. R. Simplot Co., Pocatello; front row, left to right: Jerry Brim, Wilson & Geo. Meyer & Co., Denver; and Bill Coit, J. R. Simplot Co., Salt Lake City.
4. Nitrogen Fertilizer Producers—Back row, left to right: M. J. 'Bud' Hartman, Phillips Petroleum Co., Bartlesville, Okla.; Duane Fountain, Phillips Petroleum Co., Denver; Wright Erwine, Phillips Petroleum Co., Denver; and William Mierke, Bennett Chemical Co., Denver. Front row, left to right: Bill Griffith, Phillips Petroleum Co., Denver; Ed McMillan, Spencer Chemical Co., Colorado Springs, Colo.; and Jack Crail, Spencer Chemical Co., Colorado Springs.
5. Colorado Fertilizer Mixers and Dealers—Back row, left to right: Eric Hildebrandt, Colorado Plant Food Co., Rocky Ford; R. E. 'Monty' Monteith, Simplot Soilbuilders, Greeley; Frank Randall, C. D. Smith Co., Grand Junction; Bob Barr, Agricultural Service Co., Delta, Colo.; and George Fleming, Farm Chemicals Co., Longmount. Front row, left to right: Elwin McVickar, Wylie Elevators, Wylie, Colo.; Don Croft, San Luis Valley Fertilizer Co., Alamosa, Colo.; and Fred Kroeger, Farmers Supply Co., Durango, Colo.

(Photos Courtesy of National Plant Food Institute)

Banker Talks "Dollar Side" to N. E. Fertilizer Conference

Larger investment in farms and increasing expenditures for machinery and fertilizer place an increased emphasis on the dollar side of farming, Derl I. Derr, assistant secretary of the Agricultural Committee of The American Bankers Association, New York, Oct 12 told the Northeastern Fertilizer Conference at Schine Inn, Chicopee, Mass., under sponsorship of the National Plant Food Institute.

He said these adjustments have important implications for the amounts and types of credit needed by farms and agribusinesses.

"Agriculture in the aggregate has entered the decade of the 60's," Mr. Derr continued, "in a sound financial position, with total assets of farmers exceeding $206-billion. However, less favorable income during recent years and a slowdown in the year-to-year increase in farm real estate values indicates that the entire agricultural industry will have to take a careful look at credit standards and realize the growing importance of capital and credit.

"The key factor in the current agricultural revolution is the extent to which capital has been substituted for labor. Average value of production assets per farm worker increased fourfold during the past two decades to a present high of over $21,000. Associated with this greater investment has been a rapid increase in the use of nonfarm-produced inputs. Significant changes have occurred in the use of machinery and fertilizer.

"The economic growth problem in agriculture is related to the development of sizes of farms that will effectively utilize modern technology and production methods. The 1959 Census information indicates that 33 per cent of the commercial farms in this country had sales of $10,000 or more. Regionally, the New England states ranked second, with 51 per cent of their commercial farms having sales of $10,000 or more. Livestock and livestock products represented nearly 70 per cent of the $3.8-billion gross income received by some 329,000 farmers in the 12 Northeastern states during 1960.

"The adjustment taking place in farming clearly indicates the growing importance of the 'dollar side of farming,' with the general implication that credit will become an increasingly important tool of farm management during the 60's. Lending agencies will be dealing with fewer but larger farmers, who will approach the matter of borrowing money with less restraint than did their fathers. Tomorrow's commercial farmer will approach his banker with detailed farm plans which will indicate timing of needed credit extensions as well as repayment schedules geared to the earning ability of his operations. He will be especially interested in arranging all of his credit needs at one institution.

"Four ways in which bankers are meeting the changing financial needs of farmers and agricultural businesses are: (1) hiring agriculturally trained men to work with farm families on sound credit arrangements; (2) broadening credit services by strengthening their own capital position as well as developing credit relationships with institutions in the capital centers; (3) streamlining loan programs to meet changing needs in agriculture; (4) progressively offering a complete line of financial services to the agricultural sector, including agribusinesses.

"Agriculture will remain a basic and important industry in our country. Interregional adjustments in agriculture will continue, with farmers in the Northeast experiencing increased pressure in marketing of their products. However, such competition will encourage a progressive marketing program enabling them to maintain and increase their share of the nearby metropolitan markets.

"Capital and credit needs of agriculture will mount in the Northeast as well as throughout the rest of the country."

National Solutions Assn. Meeting in Chicago

From October 30 through November 1 the fast-growing fertilizer solutions industry is in session at the Edgewater Beach Hotel, Chicago. Some idea of the spirit of this event may be gleaned from the title of one of the talks—"The care and feeding of ideas."

Round Table Featuring Materials Handling

The Fertilizer Industry Round Table meeting, November 8-10 at the Mayflower Hotel, Washington, D. C., will major in the vital subject of Materials Handling. All interested fertilizer people are invited, and need not be members of any association.

Safety Schools Set For Three More Regions

Three additional regional safety school meeting dates have been announced for November and December.

The Southwest school will be held at the Jung Hotel in New Orleans, La., on November 16-17.

The Midwest school will be held in Chicago, Ill., November 30-December 1, at National Safety Council headquarters.

The Northeast school will be held in New York City December 7-8, at the French Building, 551 Fifth Ave.

The schools are sponsored jointly by the Fertilizer Section of National Safety Council and National Plant Food Institute. W. C. Creel is chairman of the supervisory training project this year.

The schools are open to all supervisory personnel in the fertilizer industry, and the only cost is a small registration fee.

Industry Meeting Calendar

DATE	EVENT	LOCATION	CITY
Oct. 30-Nov. 1	National Fertilizer Solutions Assn.	Edgewater Beach Hotel	Chicago, Ill.
Oct. 30-Nov. 1	Official Agricultural Chemists	Shoreham Hotel	Washington, D. C.
Nov. 2-3	Pacific N.W. Fertilizer Assn.	Gearhart Hotel	Gearhart, Oreg.
Nov. 8-10	Fertilizer Industry 'Round Table'	Mayflower Hotel	Washington, D. C.
Nov. 12-14	California Fertilizer Association	Jack Tar Hotel	San Francisco
	1962		
Jan. 10-12	Agricultural Ammonia Institute	Sheraton-Jefferson Hotel	St. Louis, Mo.
Feb. 15-16	Midwest Industry & Agronomists'	Edgewater Beach Hotel	Chicago, Ill.
June 10-12	National Plant Food Institute	The Greenbrier	White Sul. Spgs., W.Va.

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- **AMMO-NITE®** Ammonium Nitrate (prilled)
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The five men at the left appeared on the first day's program at the Southeastern Fertilizer Conference: (left to right) G. Allen Burson of Cotton Producers Association, Atlanta; Tom McCabe, Montgomery (Alabama) County agent; Dr. Ralph Wehunt, Tennessee Valley Authority, Wilson Dam; Tom McCutcheon, Obion (Tennessee) County agent; and Dr. Robert L. Beacher, southern regional director for National Plant Food Institute.

The four men at the right appeared on the second day's program at the meeting: (left to right) Dr. Irvin M. Wofford, Southern Nitrogen Company, Savannah; Dr. E. T. York, Federal Extension Service; Raoul Alstetter, vice president of National Plant Food Institute; and Dr. U. S. Jones, Clemson College.

250 Attended —

Southeastern Conference Program Aimed at Today's Problems

The Southeastern Fertilizer Conference, sponsored by the National Plant Food Institute, held its 6th annual meeting October 5-6 at the Biltmore Hotel, Atlanta. Southern Soil Research, Southern Extension Agronomists, Southeast Regional Advisory, and Southeast Regional Research and Education Committees met.

The program committee for the conference was headed by G. A. Burson, Cotton Producers Association, Atlanta, chairman, and included: W. M. Campbell, Dixie Guano Company, Inc., Laurinburg, N. C.; J. H. Epting, Epting Distributing Co,, Leesville, S. C.; J. W. Fitts, North Carolina State College, Raleigh; R. L. Beacher, NPFI, Atlanta.

Mr. Burson praised NPFI, extension folks and other industry sales aids.

Tom McCabe, Montgomery County Agent, Montgomery, Alabama, and Tom McCutcheon, Obion County Agent, Union City, Tennessee, each told of the effectiveness of organized programs in his county.

Mr. McCabe described his county's agricultural area as mostly pasture and its number one limiting factor as soil fertility. Color slides were used throughout to describe his county's soil and show results of their demonstration plots and fertility program. In the following paragraphs he tells some of the things they have been doing in their program:

"In the past two years, we have held several county-wide meetings and tours, and we have established numerous fertilizer demonstrations," said Mr. McCabe. "These events were planned to fit our county's needs for information and to encourage adoption of improved soil fertility practices.

"We've had a soil testing lab available to farmers for a number of years. But Montgomery County farmers were not taking advantage of this valuable tool. Some of our leading farmers were openly critical of recommendations made by the Soil Test Lab. This indicated a lack of understanding of the basis of soil testing. So, with our Extension Agronomist, J. C. Lowery, we planned a one-day Soil Fertility School. We asked the fertilizer industry in Montgomery for help in interesting the farmers in the school. They helped. In February when the school met, our auditorium was filled to capacity.

We established several result demonstrations in cotton, pasture, and hay production using soil test recommendations as a basis for the fertilization of these crops. The results were good. No more criticism of the recommendation of the Soil Testing Lab, an increase in the number of soil tests taken. Farmers made 62% more soil tests that year than they had made any previous year. We didn't have a specific soil test program this year and the number of soil tests used by farmers had decreased somewhat.

"This year we wrote everyone who owned or operated pastures that would be on the route of the annual pasture tour, told them the plans for the tour, asked them if they had anything on their farm that they thought would be of interest to our group. We didn't get a single reply. On the tour date, however, every pasture on the tour-route was mowed. Some had received complete fertilization. They looked better than I have ever seen them.

In presenting Obion County's Soil Fertility Program, Tom McCutcheon said that he felt it had done more to increase farm income than any program he had worked with in his nine years with the Agricultural Extension Service. He described it as a fast moving, aggressive and intensified —an "off your rear and on the steer program."

The 1961 program —an intensified program— got off to a good start.

"In December of 1960, a meeting was held to organize the program. Some 40 local people attended. Jim Brown with the National Plant Food Institute, and Joe Matthews, University of Tennessee Extension Agronomist, explained how the program was working in other Tennessee counties and in other states in the Southeast.

"Summer 1960—Fertilizer demonstrations of all major crops.

"December 1960 —Committees to appoint, organize, and enthuse county agriculture leaders.

"January 1961 —Finance —Publicize —Plan —Demonstrations —Committee Meetings —Special Activities —the start of the soil test program.

"February —Civic Club Meetings —Community meetings —a Soil Test Jingle Contest —Soil Fertility Meetings — more publicity — 9 Civic Clubs —9 Special Soil Fertility Meetings —15 Community Clubs —all were presented information on what an intensified soil fertility program could mean to Obion County, and slides were shown on the 1960 demonstrations using local pictures.

"March —again Community meetings over the county —tour of the State Soil Testing Laboratory in Nashville by 21 local farmers —a 160-mile trip and more publicity.

"April —more Community Club meetings —soil test week proclaimed by the county judge —more publicity —a deadline on the soil test program —a committee reports to evaluate the work done.

"One method used at the 9 special soil fertility meetings held to get more soil samples —a drawing was held for door prizes on fertilizer and lime, but to be eligible farmers had to bring soil samples to the meeting. Over 300 samples came in this way. Thirty tons of lime and two tons of fertilizer were awarded as prizes.

"In May —a TV Program —other meetings —a 600-acre demonstration on county-owned land at the airport.

"June thru September —demonstration layouts —tours of plots — more publicity —post card reminders —another soil test program —July 17th thru September 1 —a booth at the County Fair and more publicity.

"Now to details on the soil test program —the spring program started January 16 with three deadlines —February 15 —March 15 and April 15— Why three deadlines??? More soil samples came in the three or four days before a deadline. We publicized a deadline, then after the deadline, we publicized another one due to weather, tremendous response, etc., and it got more soil samples.

"Fertilizer and lime dealers displayed boxes —information sheets and soil sample tubes. Farmers took samples to dealers. Gas company trucks picked up samples.

"Extension office packed samples and mailed to State Laboratory. Dealers paid for samples. A local bank paid the postage and results were sent to the County Agent, the dealer paying for the sample, the Bank paying the postage. Of course, the original copy of the results went to farmer, with copies to the dealer, banker, and county agent.

"Financing the Soil Fertility Program was important —as it is with any program.

"A County Soil Fertility Fund was set up —30 fertilizer and lime dealers and manufacturers invested $10.00 each in the Fund . . . a total of 1500 samples —$75.00. Postage

AT THE SOUTHEASTERN FERTILIZER CONFERENCE

1. Scott Walker, Southwest Potash Corp.; Harold Green and Ed Appling, Cotton Producers Assn.
2. Tony Dozier and Loy Everett, Commercial Solvents Corp., and Bob Fisackerly, Mississippi Chemical Corp.
3. Paul Truitt, National Plant Food Institute; Fielding Reed, American Potash Institute; W. E. Shelburne, Armour Agricultural Chemical Co.; and Charlie Summerour, American Potash Institute.
4. Jack Dulaney, Allied Chemical Corp.; Jom Gordon, Cotton Producers Assn.; Leroy Tippins, Allied Chemical Corp.; and J. Roy Pratt, Jr., Republic Steel Corp.
5. George Suggs, Allied Chemical Corp.; Ty Griffeth, Cotton States Fertilizer Co.; and J. T. Asher, Allied Chemical Corp.
6. Robert Ashcraft, Ashcraft-Wilkinson Co., and Quentin Lee, Cotton Producers Assn.
7. C. B. Clay, Cotton States Fertilizer Co.; Jim Murray and Bob Hodgson, Tennessee Corp.
8. Bruce Cloaninger, S. C. Fertilizer Control Officer; Bob Montag, Ga. State Chemists Office; and R. H. Woodward, Swift & Co.
9. Joe Shepherd, Virginia-Carolina Chemical Corp., and John Allman, Southern Cotton Oil Div.
10. J. H. Epting, Epting Distributing Co., and Gordon Cunningham, Tennessee Corp.
11. Bill Watmough, Davison Chemical Div., and Raoul Alstetter, NPFI.
12. Morris Newman and L. B. Williams, Federal Chemical Co.
13. Jack Lee, Southern States Phosphate and Fertilizer Co., and T. W. Oliver, Armour Agricultural Chemical Co.
14. Buck Appleton, Potash Co. of America, and Ben Sutherland, Armour Agricultural Chemical Co.

amounted to $90.00. A local bank paid this postage to the State Soil Testing Laboratory in Nashville.

Dr. Ralph L. Wehunt of TVA's Test Demonstration Branch, Muscle Shoals, Alabama, stressed that the dealer often is the only person the farmer consults before he buys fertilizer; because of this, the fertilizer industry has a big responsibility in recommending the correct fertilizers and fertilizer practices.

TVA is concerned with lowering the cost of fertilizers to farmers and in developing and promoting efficient fertilization practices. Its work in research and development of experimental fertilizers at Muscle Shoals, Alabama, is aimed primarily at these objectives.

"Successful farmers no longer spoon-feed their crops," Dr. Wehunt declared. "They are using new and improved fertilizers and they are applying more per acre. The fertilizer dealer has been, and will continue to be, a part of this story of employing modern fertilizer know-how on American farms."

Farmers seek from their dealers the answers to many questions. Among these questions regarding such things as kinds and amount of fertilizer, proper placement, time of application, probable yield results, fertilizer costs and other subjects related to efficient fertilizer use.

To answer these important questions, fertilizer dealers must have up-to-date information; they must understand soils and fertilizers and be willing to capitalize on that knowledge.

Dr. R. L. Beacher, Southern Regional Director NPFI, wound up the morning's session with a summary of the talks presented. Motivation, he said, was the theme of each of them —moving the farmer to buy more fertilizer to make more money, moving the dealer to offer more services, moving the county agent to a more active program of education.

Dr. Irvin M. Wofford, Southern Nitrogen Co., Savannah, Georgia, who presided at the Friday morning session, introduced its speakers.

Dr. U. S. Jones, Head of Agronomy, Clemson College, Clemson, South Carolina, spoke of research in agriculture. Said Dr. Jones:

"In brief, may I call to your attention some of the research projects currently underway in the South which offer excellent opportunities for improved farm efficiency and for increased, and more efficient fertilizer use in the future:

1. Maximum yield studies on cash crops in practically all southern states.
2. Response of genetic lines to irrigation in Mississippi and to fertilization in South Carolina.
3. The soil profile modification work including new approaches to the addition of lime and phosphate to the highly acid coastal plain subsoils in North Carolina.
4. The pasture fertilization studies in Oklahoma, Florida, Georgia, Virginia, Mississippi and other southeastern states with increased emphasis on quality of forage."

Dr. E. T. York, Director, Federal Extension Service, reviewed agriculture's progress over the past 20 years and spoke of Extension's changing role in meeting some of today's problems in agriculture.

Raoul Allstetter, vice president, The National Plant Food Institute, whose talk concluded Friday's general session, summarized some of the effects that the Scientific Revolution is having and will have on farming and the fertilizer industry.

SAFETY

Safety Data Sheets From Manufacturing Chemists

The Manufacturing Chemists Association, 1825 Connecticut Ave. N. W., Washington 9, D. C., has just issued revised editions of two safety data sheets: SD-5, which relates to Nitric Acid properties and safe handling techniques; SD-8 which does the same for anhydrous ammonia.

A quote from the cover of this latter is pertinent:

"Chemicals in any form can be safely stored, handled or used if the physical, chemical and hazardous properties are fully understood, and the necessary precautions, including the use of proper safeguards and personal protective equipment, are observed."

These papers are available from the Association for 30c each, or three for 50c.

Safety Schools Set For East and Southwest

Middle of this month, and early next month, two more safety schools will be conducted under the joint sponsorship of NPFI and the Fertilizer Section of the National Safety Council. Fertilizer managements which have reckoned up the cost of lost-time accidents in their plants, and recognized that something can be done about them, have been sending their safety people to these meetings for some years.

The programs are presented by leading experts in safety, men who speak from hard-earned experience, and who offer strictly practical solutions to a serious and costly problem.

Southwest School

The immediate school will be held this month. It is the Southwest Regional School, and is scheduled for November 16-17 at the Jung Hotel, New Orleans.

The school to follow, the one to be held in New York, is dated December 7-8 at the New York School of Industrial and Labor Relations, 551 Fifth Avenue, N. Y. C.

Northeast School

Typical of these schools are the following features, extracted from the New York program.

December 7

"Management Looks at Safety", Donald Ackley, Director of Personnel, G & O Radiator Company.

"The True Story of Accident Costs", W. C. "Billy" Creel, Safety Director, North Carolina Department of Labor.

"Setting 'em Straight", a Communication for Safety Film.

"A Practical Program for Training Supervisors", Professor Harlan B. Perrins, N. Y. State School of Industrial and Labor Relations.

Group Luncheon —Dubonet Restaurant.

"The Importance of Fire Protection in Industry" (New York Fire Training Specialist).

"Flammable Engineers", a special safety film on flammable materials handling.

"Housekeeping and Fire Protection", E. O. Burroughs, Jr., Manager Insurance Department, F. S. Royster Guano Company, Norfolk, Virginia.

"A Fire Extinguisher Program for Fertilizer Plant".

Questions and open discussion on Fire Protection.

December 8

"The Basic Ideas on Hazardous Liquids and Why They Are a Problem in the Fertilizer Industry", Elmer Perrine, Director Technical Service, Allied Chemical Corporation, Nitrogen Division.

"Practical Company Programs for Hazardous Liquids and Related Materials", a representative from four different fertilizer companies will discuss his company's methods of recognizing and solving problems created by: (1) Sulphuric Acid, (2) Anhydrous Ammonia, (3) Other Ammoniating Solutions, (4) Ammonium Nitrate.

Discussion 66 — "Problems We Would Like to Have Solved", an informal method of getting participation from every conferee and at the same time furnishing practical answers to current safety problems.

Representative Group Offers Minor Element Regulation

Meeting recently with the Association of American Control Officials Committee on Fertilizer Guarantees and Tolerances, fertilizer industry men from various parts of the United States together with agronomists from the various states and federal agencies, drafted the following proposed regulation of minor elements, and offered it for adoption as part of state fertilizer laws:

Additional plant nutrients, besides nitrogen, phosphorus and potassium, when mentioned or claimed on the label or container shall be registered and shall be guaranteed. Guarantees shall be made on the elemental basis. Sources of the elements guaranteed shall be shown on the application for registration. When such claims are made on the label, container, or application for registration, the minimum percentages which will be accepted for registration are as follows:

Element	%
Boron (B)	0.02
Calcium (Ca)	1.00
Chlorine (Cl)	0.10
Cobalt (Co)	0.0005
Copper (Cu)	0.05
Iron (Fe)	0.10
Magnesium (Mg)	0.50
Manganese (Mn)	0.05
Molybdenum (Mo)	0.0005
Sodium (Na)	0.10
Sulfur (S)	1.00
Zinc (Zn)	0.05

Guarantees or claims for the above-listed additional plant nutrients are the only ones which will be accepted. Proposed labels and directions for use of the fertilizer shall be furnished with the application for registration, when requested. Warning or caution statements are required on the label for any product which contains 0.03% or more of boron in a water-soluble form or 0.001% or more of molybdenum. Any of the above-listed elements which are guaranteed shall appear in alphabetical order immediately following guarantees for the primary nutrients, nitrogen, phosphorus and potassium.

Farmers now get as much production from 100 acres as they did from 175 acres ten years ago. Better feed, use of more lime and fertilizers, better crop tillage, pesticides, and other developments in agriculture are the reasons. The efficiency of farming will continue to increase as agricultural technology continues to advance.

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60—1350 gal. vert. 347 SS tanks, 4'x14', coils.
9—1300 gal. vert. 321 SS tanks, 7'x4'-6".
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6—28,000 gal. horiz. lead-lined tanks, 11'x 38'.
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50—5200 gal. horiz. steel tanks, 6'x 24', 55 psi.
3—43.5 HP waste-heat boilers, 250 psi.
150—Worthington Worthite, centrif acid pumps, 4"x3", 3"x2", 2"x1½", etc.
30—LaBour 2" self-priming, Stainless pumps.
50—Pfaudler 600 gal. jkt. Stainless kettles.
18—Pfaudler 1250 gal. jkt. blue glass lined reactors, closed dished heads, Agit.
70—Pfaudler 1400 gal. jkt. blue glass lined kettles, open top, 3 HP Agit., baffle.
70—Pfaudler 250 gal. jkt. glass lined kettles.
6—1450 sq. ft. T347 SS heat exchangers.
3—1000 sq. ft. Duriron pipe coolers.
9—400 sq. ft. T304 SS pipe coolers.
6—162 sq. ft. T316L SS spiral heat exchangers.
15—Ing.-Rand 6 x 6 x 5 air comp., #67D9, type 30.
1—Raymond 66", 6-roller hi-side mill.
2—Davenport 8'x60' rotary dryers.
50,000'—Stainless Steel pipe, all sizes.
10,000'—Stainless vapor pipe; 6", 12" 20" dia.
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Edited by VINCENT SAUCHELLI, Chemical Technologist, National Plant Food Institute.

ACS Monograph, 1960, 704 pages, $18.00

Leading authorities in the field discuss the raw materials used in chemical fertiilzers and the conversion of these materials to suitable chemical compounds for the feeding of crop plants.

Among the topics discussed are the factors controlling the preparation of conventional mixed fertilizers, the caking problem, the theory and practice of drying and cooling fertilizers, liquid fertilizers, and corrosion and methods of preventing it in the manufacturing process. Extensive coverage is given to phosphate ore, its mining and processing. In addition, the authors discuss nitrogen compounds, potash salts and granulated fertilizers. The book also includes a detailed description of the processing equipment used in a modern plant.

Broad in scope, accurate, completely up-to-date, this book will be of special value to chemists, chemical engineers, plant superintendents, and to management charged with the responsibility of selecting efficient and economical processes for the production of fertiilzers.

CONTENTS: The fertiilzer Industry of the United States; Nitrogen; Phosphate Ore; Phosphate Rock; Normal Superphosphate; Manufacture of Triple Superphosphates; Wet-Phosphate Acid Manufacture; Diammonium Phosphate as Produced at By-Product Coke-Oven Plants; Operating Techniques, Equipment and Practices in Manufacture of Granular Mixed Fertilizers; Manufacture of Concentrated Water; Nitrophosphates and Miscellaneous Phosphates; Thermal Process for Producing Phosphate Fertilizers; Potash Occurrences, Processes, Production; Plan Practices in the Manufacture of Nongranulated Mixed Fertilizers; Minor and Secondary Elements in Mixed Fertilizers; Caking of Mixed Fertiilzers; Fertiilzer Materials; Liquid Fertilizers; Structural and X-Ray Data on Chemical Compounds Found in Fertilizers; Corrosion; Materials of Construction for Fertilizer Plants and Phosphoric Acid Service; Materials; Gaseous Effluence for Fertilizer Granulation Plants.

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CF Staff-Tabulated TONNAGE REPORTS

FERTILIZER TONNAGE REPORT (in equivalent short tons) Compiled by Cooperating State Control Officials and Tabulated by COMMERCIAL FERTILIZER STAFF

	September		August		April-June Qtr.		January-June		July-December		YEAR (July-June)	
STATE	1961	1960	1961	1960	1961	1960	1961	1960	1960	1959	1960-61	1959-60
Alabama	------	39,323*	25,354	23,789	548,583	612,918	812,241	869,240	181,587	180,959	993,828	1,050,199
Arkansas	16,090	13,380	12,047	8,666	217,881	204,314	312,038	303,835	61,633	58,713	373,671	362,548
Georgia	14,142	22,969	41,520	25,274	1,063,441	947,923	1,202,510	1,102,220	313,241	299,194	1,515,751	1,401,414
Kentucky	------	22,752*	------	14,545*	288,920	319,164	459,375	461,786	102,192	108,734	561,567	570,520
Louisiana	------	12,999*	7,100	7,120	147,176	150,438	220,340	224,087	73,814	66,744	294,154	290,831
Mississippi	45,594	43,921	24,313*	------	349,135	374,717	550,528	545,423	145,632	144,374	671,918	689,797
Missouri	------	83.871*	57,853	49,891	386,185	434,606	547,116	524,336	334,657	277,708	881,783	802,044
N. Carolina	------	40,007*	14,130	16,658	870,935	988,133	1,371,080	1,381,263	202,694	175,533	1,573,774	1,556,796
Oklahoma	------	38,198*	17,930	16,653	51,411	52,726	87,844	72,246	94,690	72,511	182,534	144,757
S. Carolina	19,413	21,039	31,114	25,064	305,326	411,739	693,165	678,986	110,096	104,903	803,261	783,889
Tennessee	37,690	38,701	28,724	27,256	317,830	353,905	467,997	482,980	124,747	117,275	592,744	607,727
Texas	------	57,509*	39,949	32,845	308,879	281,701	531,678	474,626	234,376	233,410	766,056	708,037
California		(reports compiled quarterly)			480,241	462,857	835,001	813,116	462,347	465,495	1,297,348	1,278,611
Virginia		(reports compiled quarterly)			310,830	369,502	569,001	591,113	168,479	141,177	737,480	732,290
Indiana		(reports compiled semi-annually)					797,711	828,164	317,372	321,956	1,115,083	1,150,120
TOTAL	132,929	140,010	275,721	233,216	5,646,773	5,964,643	9,457,625	9,353,421	2,927,557	2,768,686	12,360,952	12,129,570

------ (not yet reported) * Omitted from column total to allow comparison with same period of current year.

— INDEX TO ADVERTISERS —

SULPHUR

View of our new large main storage and shipping terminal at Beaumont, Texas. Solid sulphur vats (top center)—part of our large inventory—with molten sulphur storage tanks to their right. Freighter (center) taking on solid sulphur; tank barges (right) loading molten sulphur. Empty freighter (lower center) at holding dock.

2,500,000 tons-PLUS

...a healthy reassuring TGS inventory!

At the close of 1960 stocks of Frasch-mined Sulphur in the United States...and it is this Sulphur that accounts for most of the world's inventory...totaled about 3,650,000 long tons.

What is the TGS contribution to this inventory? Better than two thirds. Combining inventories at its four Frasch producing properties in Texas with stocks at its main and regional terminals, TGS has a running inventory of about 2,500,000 tons or about 70% of U. S. total inventory. In addition, there is a considerable inventory at its gas recovery plant in Okotoks, Alberta.

2,500,000 long tons **plus** of TGS Sulphur...indeed, a healthy reassuring inventory!

TEXAS GULF SULPHUR COMPANY
75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas
Sulphur Producing Units: Newgulf, Texas • Moss Bluff, Texas
Fannett, Texas • Spindletop, Texas
Worland, Wyoming • Okotoks, Alberta, Canada

Automatic bag placing and filling . . . shown here is the Raymond Bag Packer (top half of photo) and the Raymond Bag Placer (bottom)

INDUSTRIALLY PROVEN... *the Raymond Combination*

Raymond
BAG CORPORATION
Middletown, Ohio
A Division of Albemarle Paper Mfg. Co.

ROTOMATIC BAG PACKER—BAG PLACER

Here's a proven step towards automating your packing line. The Raymond combination Bag Placer and Bag Packer will automatically hang bags on packing spout and fill them at the rate of 25 bags per minute . . . proven in full production line operation. The development of the Raymond Bag Placer, which is designed to operate with all open mouth packing equipment, is another step forward towards completely automatic bag placing, filling and closing operations. For details on the Raymond Packer Placer combination or separate units, contact your nearest Raymond Representative or write

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